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Volume 81 October 3, 1918 Number 14

Engineering News-Record

A CONSOLIDATION OF ENGINEERING NEWS AND ENGINEERING RECORD, WITH WHICH IS INCORPORATED THE CONTRACTOR.

E. J. MEHREN, *Editor*

CHARLES WHITING BAKER, *Consulting Editor*

Altering Old Office Building Requires Heavy Underpinning 610

BRICK ARCH floor 60 by 100 feet in area raised three feet in two sections—Thick first-story brick bearing wall replaced by steel framing.

Engineering News-Record, Oct. 3, 1918. 6 cols. Ill.

Road Culvert Checks Destructive Storm-Water Flow 613

NEW DESIGN prevents erosion of ditches and farm lands, guards against washouts and fills gullies by silting.

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Urges Study of Unit Operation of Railroad Terminals in Large Cities 615

YARDS AND TERMINALS COMMITTEE, Railway Engineering Association, presents catechism, recommends investigation by representative committees of possibilities of coördinating existing facilities.

Engineering News-Record, Oct. 3, 1918. 9 cols.

Lay Down Lines of Organization for Contractors' Association 619

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Government's Mississippi Barge Fleet Now Building 621

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Supplementary Artesian Supply for Indianapolis 633

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Published Weekly. Entered as second-class matter Apr 11, 1917, at the Post Office at New York, under the act of Mar. 3, 1879

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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. Mehren, Editor — Charles Whiting Baker, Consulting Editor

Volume 81 — NEW YORK, THURSDAY, OCTOBER 3, 1918 — Number 14

The Colleges Respond

PLAYING their part in the people's war, some 500 American colleges, with perhaps 150,000 students, were simultaneously turned into army training camps on Oct. 1. Engineers will be more fortunate, in a strictly educational sense, than most of the other students, because aside from the military drill, required of all alike, they will devote themselves chiefly to engineering studies during the three, six or nine months or longer period before they enter upon full military training or active service. Intensive training in various industrial specialties, such as has been given of late at many engineering schools, will be continued. The reaction on students and instructors, both in technical and other courses, will be watched with great interest. This great experiment may have a profound permanent effect on college education. The main thing today is that the colleges have responded to the call of freedom.

The People's Money For the People's War

TRUER and more significant words were never spoken than those of President Wilson on Sept. 27 when he declared that this war "has become a people's war." Whatever it may have been at the start it is now a war "of the people, by the people, for the people." We have entered upon a campaign for our Fourth Liberty Loan. The people's money is needed for the people's war. For previous loans we have subscribed more than $12,000,000,000 of our savings. We are now asked for $6,000,000,000 more. Again we will oversubscribe. Let no one think that money alone will win the war. Blood is the sacrifice required. But money will lessen the blood which must inevitably be shed. It will hasten "the final triumph of justice and fair dealing" awaited by a world that will accept nothing less.

Allocating Railway Value to States

ONE problem not encountered by the Interstate Commerce Commission in its first final valuation, because the Texas Midland R.R. is all in one state, is that of distribution of property between states. The commission indicates in the Texas Midland report, however, that it will follow the simple course of crediting fixed property to the state where it is found, and listing equipment in one item as unassignable. Much more troublesome the commission finds the suggestion that the value of important structures ought to be distributed to states other than those in which the structures themselves are situated. To illustrate, it concedes that the Pennsylvania's New York terminal benefits the lines west of Pitsburgh. "When, however, any basis for such distribution is sought," says the commission, "the impossible nature of the problem of distribution appears, and above all the express language of the act seems to forbid. This station is in the State of New York and should be so reported." Which means that if occasion demands an equitable determination of value by states some other agency than the Interstate Commerce Commission will have to guess how to make it.

Influenza Must Be Stamped Out

APPROPRIATION by Congress of $1,000,000 to enable the U. S. Public Health Service to help combat influenza indicates how serious the present epidemic may become if it is not speedily put down. Engineers and contractors responsible for groups of men, large or small, should inform themselves immediately as to both precautionary and combative measures—which they can readily do by appealing to their local or state health authorities or to the U. S. Public Health Service. In some localities engineers may need to inquire whether their local health authorities are alive to the situation. At this crucial moment our armies and our war industries must not be crippled through any lack of ordinary, or if need be extraordinary, health precautions. A duty rests on each individual; as to himself, his immediate associates and his community.

Committee on Yards and Terminals Again on the Job

NO COMMITTEE of the American Railway Engineering Association has shown a keener perception of the needs of the present war emergency than the yards and terminals committee. Last March it issued a report and catechism aimed to point the way to improving the operation of existing yards by minor physical changes and by improvement in operating methods, in the absence of time or opportunity for extensive construction and reconstruction of yards. Since then the true import of the possibilities of unified operation has come to be felt. Unified operation naturally begins at the large city terminals. So the yards and terminals committee has produced a special report on terminal unification, and a second catechism. The catechism and other parts of the report are printed on p. 615. The committee deserves warm commendation for being again—or still—on the job.

Also the Minor Railroad Officers

DIRECTOR GENERAL McADOO well says, in his report to the President on the first seven months of Government operation of the railroads, that "the salaries paid to the higher railway officers should be commensurate with those of private enterprise and industry"; and he has lived up to the theory by retaining to direct this $20,000,000,000 worth of property a pay roll only $4,000,000 less, despite the ousting of some 400 presidents, than prevailed under private control—a pay roll that includes salaries far higher than his own or those of any other Government official except the President himself. But he could well turn his attention to the lower officers. It is a common saying that the fighting quality of an army depends on its sergeants. What would be thought of a scheme of army pay in which sergeants were paid less than the privates they commanded? In the army of railway workers, however, it is not at all uncommon for foremen and superintendents and educated technical workers to receive lower pay than some of the workmen under them. Whether the railways are operated after the war by the Government or are returned to the companies, the efficiency of their operation will depend very largely on the character of the few thousand minor officers. To pay these men inadequate salaries will in the long run inevitably mean that the places will be filled with incompetent men, and the public will be the chief sufferer.

Wanted—A Connected National Highway System

A CONNECTED workable plan of highways for the United States does not exist. This will be apparent to anyone who will examine a map showing the various Federal-aid projects approved in the past few years. The condition is not the fault of the engineers who have supervision of the Government work, but of the law which puts the chief function of selection upon the political division of the country to which the aid is to be given. This has resulted in an indicated system of such proportions that it is estimated that it would take upward of 150 years at the present rate of building to bring it up to a unit. The states have highway departments. Why not a United States highway department? The states have highway systems. Why not a Federal highway system? At the least, Congress might well provide for a careful engineering study of the national aspects of the highway problem as an aid to making ready for the great reconstruction period to come when the war closes.

Is This Disguised Enemy Propaganda?

THERE are many ways to impede the successful prosecution of the war. Fortunately, most of them are now punishable by law, but one remains which may be practiced with impunity. That is the sneering reference to the "bomb-proof" jobs at Washington. Started by certain Congressmen jealous at their growing loss of importance at the capital, this habit has spread in conversation and press until it assumes the importance of enemy propaganda, so serious has been its effect on the morale of the thousands of loyal and hard-working Americans giving freely of their time and money—for few at Washington in war work can live within their income there—at what is in effect the Great Headquarters of the American cause. Many of these men are engineers, for whom this journal feels competent to speak. The importance of their work at Washington should require no argument; the serious necessity for most of those there is obvious to any one at all conversant with the innumerable details of war. Finally, if those who are there were granted their dearest wish, which is to join that army for which they are all working, their places would have to be filled with others whom the same slanders would attack. After the war these men will not share the glory that will attach to every one who has seen service in France. Can they not now be accorded the respect which should be the due of every man who serves his country according to his country's needs?

The Task Confronting the Contractors

UP TO THE present time no considerable proportion of influential contractors has ever been interested in the formation of a national organization to look after their especial needs. This in spite of the wonderful demonstrations of the possibilities of such an organization afforded by a number of strikingly successful local associations of general contractors. Though the contractor is the sole employer of construction labor, he has permitted labor to become nationally organized without even considering the necessity for nationally organizing himself to treat intelligently with labor. Though the contractor is the sole buyer of construction materials and construction equipment, the manufacturers of every sort and kind of material and equipment have long been nationally organized and have led the progress and shaped the developments in the construction field, while the contractors have sat idly by.

It took the upheaval of war conditions to force home to contractors the truth that nobody can be expected to look out for their national interests except themselves. Contractors in Omaha and Atlanta, Albany and San Diego, began to find themselves in exactly similar troubles, which were beyond remedy through local influences on which they had been wont to rely, and to which existing national organizations or those connected with building and construction were indifferent, not being directly affected. It became increasingly evident that the contractors needed a national organization of their own, and that the work would be cut out for such an organization from the start.

There is no need to review the difficulties confronting contractors, nor to point out again their solution. The difficulties are only too well known, and the way out is to be found by hard work along the lines laid down by the Committee on Organization of the new National Association of General Contractors, reported on page 619.

It remains to be seen, however, whether the contracting fraternity of this country will make this association the universally supported, progressive force that it ought to be in the construction field. Will the greed of large firms who feel themselves so strong as to be independent of the rest of the world prevent their

supporting the movement? Will the localized interests of the average general contractor continue to blind him to the national aspects of his own business, and prevent his joining the movement in sufficient numbers to insure immediate success?

We think not. Scarcely a contractor but has had borne in upon him during the past few months that forces beyond his control are having a disastrous effect on his business. What more natural than that contractors should welcome an organized effort to deal with these forces nationally and to interpret them through a national organization to the individual? The enthusiasm and determination of the contractors brought together at Atlantic City and in the meetings of the executive committee on organization there formed are a further guarantee of success to the new organization. Fully awake both to the dangers and the possibilities of the situation, and determined to make the most for the industry and for their own business of the situation, these men will leave no stone unturned to inspire the contractors in their territory to action. The determination and enthusiasm manifested at the meeting in New York is of the sort that does not stop short of the accomplishment of its object. The movement will succeed, to the everlasting benefit of the construction business in this country.

Land Reclamation and Reconstruction

THIRTY years ago, on Oct. 2, 1888, the Congressional act which made possible the irrigation survey organized by Major John W. Powell was signed by President Cleveland. That survey, as carried out by Major Powell and his successor at the head of the Geological Survey, Charles D. Walcott, prepared the way for the creation of the U. S. Reclamation Service under President Roosevelt. The service has since built many dams, some record breaking, great networks of canals, and thousands of major and minor structures, all of which together have made possible the irrigation of vast areas of otherwise arid lands, provided homes for thousands and contributed largely to the food supply of the world.

The Powell irrigation survey, the later and still continuing hydrographic surveys, the extensive and intensive investigations of the Reclamation Service associated with various irrigation projects have given Congress and the country at large some conception of the water resources of the country and the vast regions awaiting conversion from aridity to fertility.

Great as have been these accomplishments, the land reclaimed is only a small part of what is available for reclamation—by further irrigation, by drainage and by clearing cut-over land. What these areas are and what the reclamation of only a portion of them would mean in the way of providing work and homes for returning soldiers was set forth by Arthur P. Davis, chief engineer and director of the U. S. Reclamation Service, in our issue of Aug. 22, 1918, p. 361. These possibilities have repeatedly been laid before the public in the spoken and written words of Secretary Lane.

Responding in part to Secretary Lane's pleas for ample funds with which to conduct further reclamation surveys, Congress has made available $100,000 for drainage and cut-over land investigations. An equal sum is also available for further irrigation studies. While more was needed, these sums have made it possible to start investigations under the able district leadership of F. E. Weymouth, F. W. Hanna and H. T. Cory, with the counsel of Prof. Elwood Mead and the direction of Mr. Davis, as announced in our issue of Sept. 5, p. 469. Accessions to the staff are given on p. 645 of this issue.

Knowledge of these studies will give heart to many in our armies. Engineers in the service may look forward to useful employment on these investigations and on the construction of irrigation and drainage works and the clearing of stump lands by modern methods which it is hoped will follow speedily the preliminary investigations.

The act of Oct. 2, 1888, made possible the beginning of the realization of the great visions of land reclamation which Major Powell saw so clearly and constantly notwithstanding a public indifference that would have meant blinding discouragement to other men. The Newlands Act and its consequences carried the realization forward under the engineering direction of Newell and Davis and with the aid of scores of able engineers. Another great reclamation survey has been initiated, but it needs further congressional support and should be heartily backed by engineers and the public. The Cleveland administration initiated investigations for land reclamation on a large scale. The Roosevelt administration started the work and gave it a mighty push forward. Yet little more than a good start has been made. The need for progress is greater now than ever before. The Wilson administration should hasten with a comprehensive reconstruction program, in which land reclamation will play the large part already proposed by Secretary Lane.

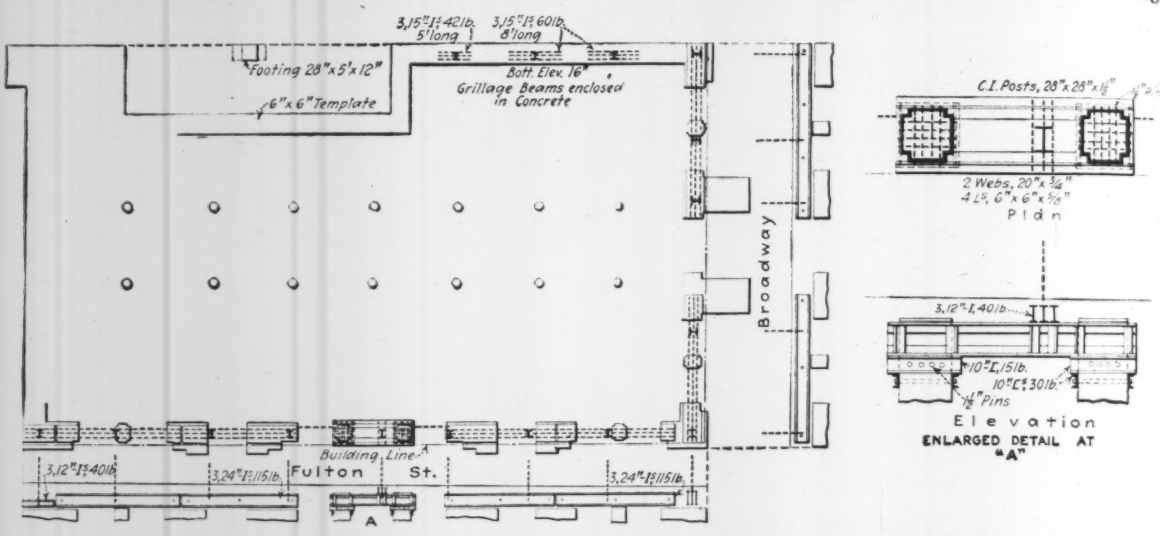
Necessity Teaches Proper Use of Irrigation Water

RESTRICTED allotments of irrigation water have taught the water users on the Orland Project of the United States Reclamation Service in California that small amounts of water well used are just as effective as deluging quantities which eventually may bring on exasperating drainage problems. The restriction the past summer was due to shortage of water, but the farmers may congratulate themselves on having been assured of a supply that was sufficient if used carefully. Engineering foresight in providing a diversion canal over a divide from an adjoining watershed saved the situation. The energy spent by the service in educating the irrigator in normal times to level his lands, to keep the ditches clean and to apply the water properly, produced its beneficial results. In sharp contrast to this was the burnt-up condition of many farms in the semi-irrigated Canadian Northwest districts. Several years of plentiful supply have made the farmers indifferent to the necessity of maintaining their ditches and land in proper condition for irrigation, so that what little water was available this year could not be used to the best advantage. With wheat at present prices it is apparent that an engineer's study of rainfall and runoff are a vital factor in the successful operation of an irrigation district.

Altering Old Office Building Requires Heavy Underpinning

Brick Arch Floor 60 by 100 Feet in Area Raised Three Feet in Two Sections—Thick First-Story Brick Bearing Wall Replaced by Steel Framing

EXTENSIVE alterations in the office building at the southeast corner of Broadway and Fulton St., New York City, formerly occupied by the New York *Evening Post*, involved some very difficult underpinning and shoring operations, which had to be carried on while practically all of the tenants remained in the building and in spite of the fact that an adjacent busy subway station prevented the use of obviously simpler methods. The structure was formerly a ten-story office building with basement and sub-basement, both extending out to the curb on both streets. It had brick bearing walls with interior cast-iron columns carrying brick arch floors on iron floor-beams. Alteration involved the raising of the second floor 3 ft. so as to permit of street-level entrance to the first story, the removal of the thick brick street walls in the two lower stories and the substitution of glass on both streets for these walls, and the cutting off of 2 ft. of the 2 ft. 8-in. brick bearing wall on the south party line on the store floor, so as to provide additional rental store floor area.



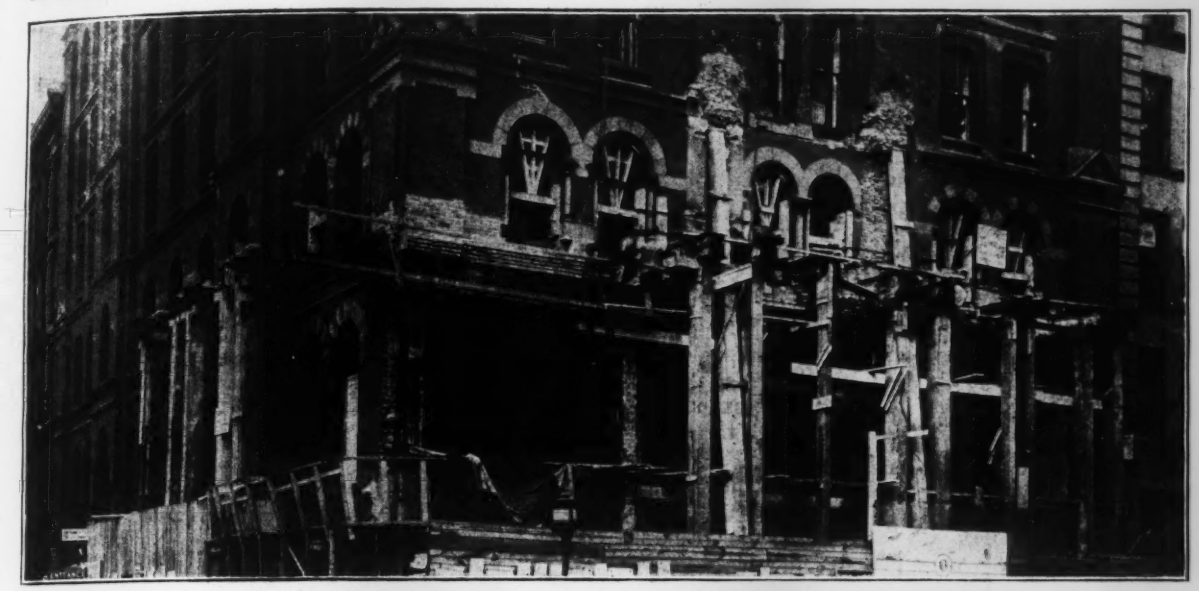
GRILLAGE PLAN IN NEW YORK OFFICE BUILDING WHICH HAD TO BE UNDERPINNED

In addition to these major operations, several minor changes were bothersome. These consisted of raising the store floor about 1½ ft. merely by placing framing of that height on the old floor; removal of the brick walls of the two topmost stories and the substitution therefor of small piers; removing the two former hydraulic elevators and extending the new electrical elevators to a penthouse above the roof; strengthening the roof to carry a possible future story, and providing necessary steel at the ninth story level in order that brick walls between the third and ninth stories could at some future time be removed without interfering with the tenants of the first, second, ninth and tenth floors. These changes were all made at the same time as the major operations, but will not be described here in detail.

Raising the second floor 3 ft., in order to provide sufficient story clearance in the first floor, involved the elevation in two sections of a floor 60 x 100 ft. The old floor consisted of 12-in. wrought-iron I-beams spaced about 4½ ft. on centers, and the floor proper, of 4-in. brick segmental arches with a rise of about 10 in. carrying a cinder fill and wood sleepers and floors. The floor-beams were supported by all the walls on the outside and by two rows of longitudinal girders resting on a row of cast-iron columns near the middle of the building. These columns had curious joints at the floor level. Instead of the base of one column resting on the other, a boxlike casting, shown in one of the drawings, was introduced between the cap and the base, and the end of the girder passed through and was supported on these boxes or pintles. To raise the floor-beams and girders 3 ft. meant that the boxes would be unbraced in all directions, which would introduce a dangerous condition. To overcome this the pintles were concreted to make solid connections.

Steel-angle frames were first bolted to the columns about 12 in. above and below the pintle. Heavy corner angles connected the frames, and the box corners were wedged tightly against the angles. The entire box was then thoroughly braced and was filled with concrete. Slots were then cut in the side walls to the proper height, and ample shores and jacks were placed underneath, on the first-story beams. The second-story girders were then cut off with acetylene torches close to the steel-column box braces and, the columns being interbraced thoroughly with wood struts, the floor was raised by jacking to its proper level. Brackets were then attached to the column box braces to support the girders at their new level, and all the shoring was removed.

There were no tie-rods between the floor-beams but this difficulty was overcome by cabling together with

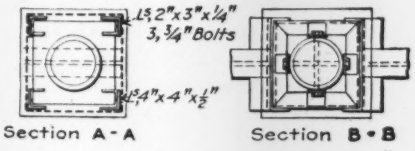


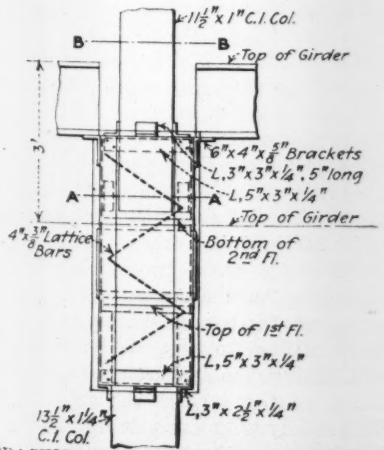
BROADWAY FRONT OF OLD EVENING POST BUILDING SHORED UP WITH STRADDLING STRUTS

steel-wire cables about twelve of the floor arches. In order to avoid leaving all the walls unbraced for a height of about 30 ft., only one-half of the floor was raised at a time. The remaining half was raised after the first operation was completed. This part of the work was considered so dangerous by the building authorities that they required about three weeks in the jacking operation on the first half of the floor. This turned out so well, however, that the second half was raised in eight hours.

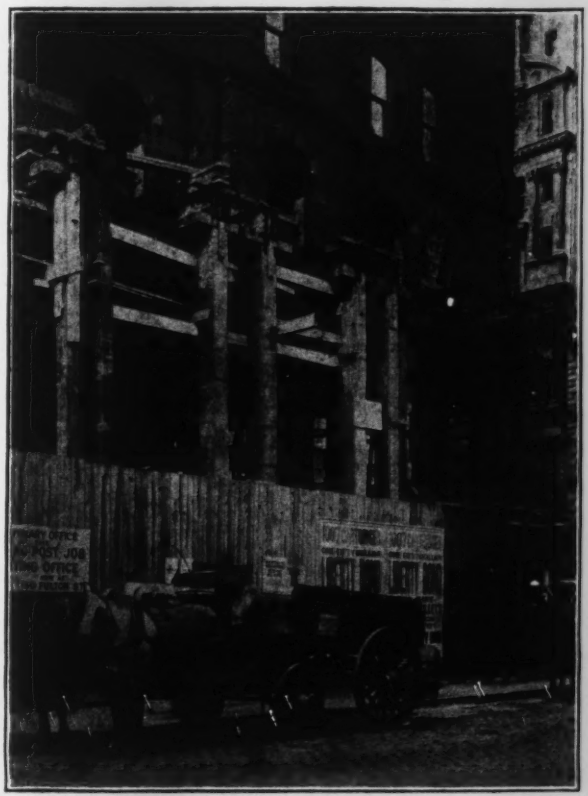
The floor was raised, instead of being taken out and replaced, because this permitted the owner to use the floor for the same loading as that for which it had been authorized before. If a new floor had been put in the building code would have required a heavier and more expensive floor system.

The removal of the front brick bearing walls on the first and second stories offered a serious problem, because conditions prevented the usual shoring methods. The basement and sub-basement, including vaults, were occupied on Fulton St. by a printing firm which would





BRACING AND REPLACING OF CAST-IRON PINTLE AT TOP OF COLUMNS

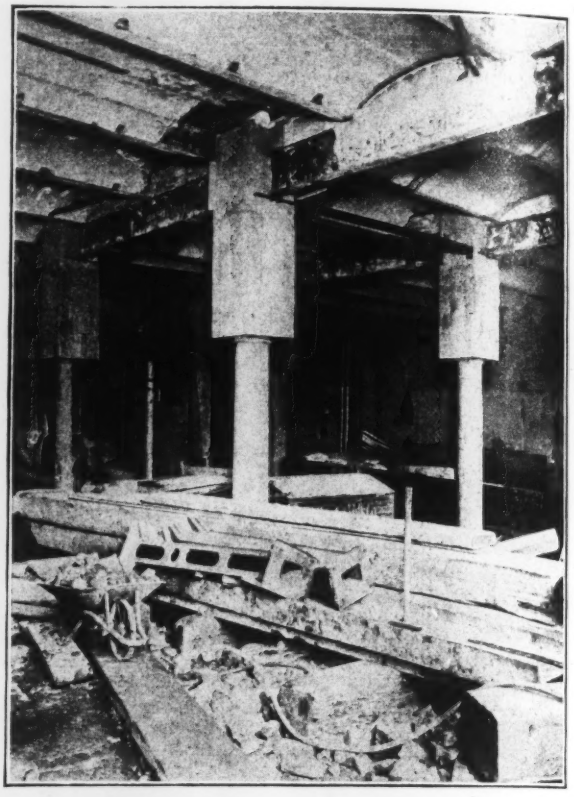


FULTON STREET FRONT, SHOWING EXTENSION SUPPORTING BEAM AT CORNER

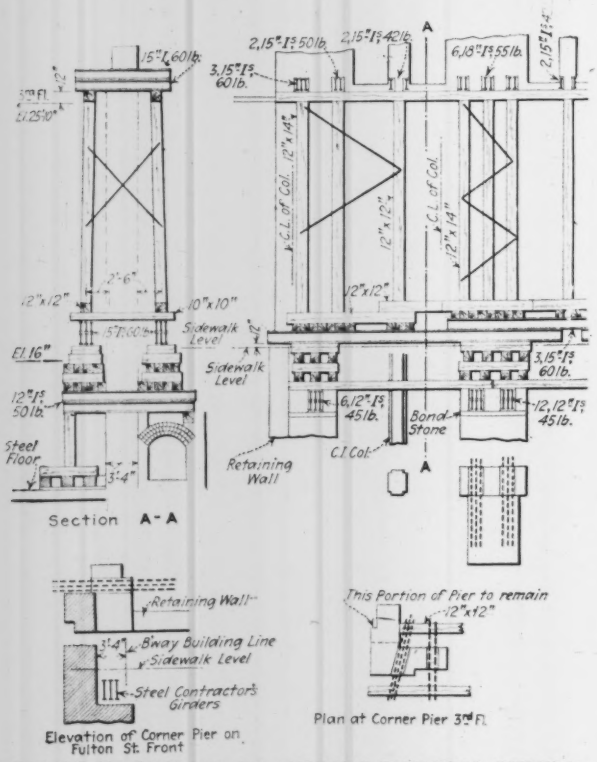
not permit any work being done near the presses. The Broadway sidewalk vault space to the curb was partly occupied by the same tenant and partly by the Fulton St.-Broadway subway station. It was thus impossible to carry the shores vertically on either street down to bearing on the ground. Instead, therefore, the brick wall (about 25 tons per linear foot) was carried on two sets of shores, straddling the wall to be removed and resting on needles protruding on either side of the brick base piers, which they pierced. New steel framing was then put in to rest on grillages bearing on the brick piers.

The drawings show the details of this shoring framing. Holes were first cut in the old piers just below the proposed new grillage level under the sidewalk and above the top grillage which would have to support the brickwork above the second story. Through these holes horizontal steel I-beam needles were placed. Longitudinal needles parallel to the walls of the building were then carried on blocking built up on the ends of the lower cantilever needles. On the top of the longitudinal beams vertical shores were placed and wedged in between the top and bottom cantilever needles running through the wall. In this manner a rigid rectangular frame was formed in a plane at right angles to the wall, extending inside and outside of the building. This permitted all of the brickwork to be taken out quickly and the new grillage and steel columns to be set in place without any difficulty.

The work on the Broadway front was completed first. In order to avoid interference of any kind with the subway stairway on the Fulton St. corner the vertical shore at that point was placed at an angle so that the bottom



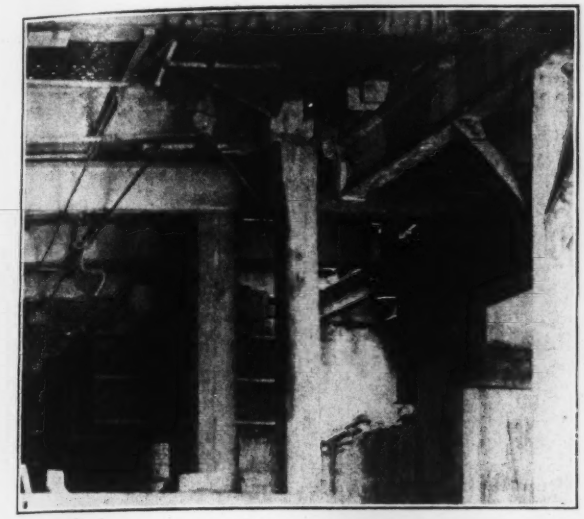
CAST-IRON PINTLES COVERED WITH CONCRETE AND BRICK ARCH FLOOR RAISED


Section A-A
Retaining Wall
Bway Building Line
Sidewalk Level
Steel Contractor's Girders
Elevation of Corner Pier on Fulton St. Front
This Portion of Pier to remain
Plan at Corner Pier 3rd Fl.

DETAILS OF SHORING TO SUPPORT BUILDING DURING ALTERATIONS

of the shore was wedged against the lower end of the new steel column and the upper end against a projection of the steel girder lintel at the ceiling of the second-floor level. This projection was made for temporary use to aid in the shoring and carried the end of a set of longitudinal needles, as shown in one of the views. These needles supported small cross-beam needles upon which two of the intermediate brick piers rested. After all the permanent steel was in place at this corner the temporary 24-in. I-beam which projected 5 ft. into Fulton St. was cut off with a blowpipe.

Other difficulties were met in taking care of two 32-in. square hollow cast-iron columns in the basement, shown in one of the drawings. These columns had to be reinforced to carry the additional load resulting from the elimination of two of the old brick piers. Two heavy-web channels were placed on opposite sides of the sub-basement columns, and clamped tight to the box column by through bolts passing clear through the boxes. The ends of these channels extended out about 4 in. beyond the column on each side and supported on top of these channels and attached to the other two sides of the columns by similar bolts were two more channels. These acted as brackets for the support of two heavy girders which ran across the two sub-basement columns. These girders were utilized to support the shoring of the street columns. Before the final weight of the street columns was placed on the girders the sub-basement columns were filled solidly with concrete up to within a few inches of the pins supporting the channel, and from



AT RIGHT ARE CHANNELS CLAMPED TO OLD COLUMN TO SUPPORT SHORING; AT LEFT MAIN SHORING GIRDERS THROUGH BRICK COLUMN

this point to the sidewalk level with a rich mixture of grout. Any movement of the supports was prevented by bracing the construction to the adjacent piers and connecting the steelwork thoroughly to the first-story floor-beams. A view of one of these columns while under reconstruction is shown in one of the photographs reproduced herewith.

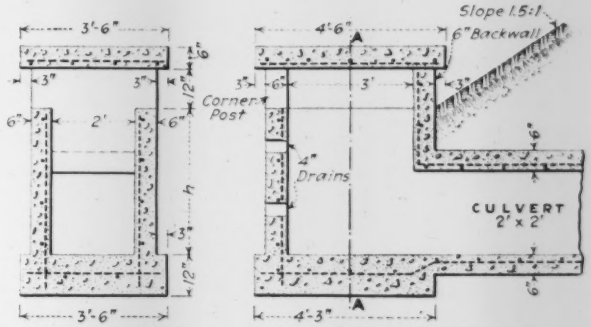
In cutting off 2 ft. of the 2 ft. 8-in. south brick bearing wall at the store level the loads on this 10-story wall were transferred to new steel columns practically without any shoring and without interfering with the adjoining building or the tenants of the basement or upper floors. This stretch of wall, about fifty feet long, was carried by three new steel columns. Vertical and horizontal slots were cut into the brick wall, of just sufficient size to make room for the new grillage and the column. After these were set in place the walls were temporarily wedged up against the steel work. At alternate spaces between the columns horizontal slots were then cut at the ceiling of the store floor of sufficient size to permit the I-beam girders to be shifted into place for bearing on the tops of the new columns. The brick wall was then wedged on the new girder, after which 2 ft. of the 2 ft. 8-in. brick wall below the girder to the store floor level was cut out. This method resulted in considerable saving in time and cost for construction, and avoided possible claim of damage to adjoining property, which might have resulted if the total removal of the wall with the underpinning had been adopted instead.

The estimates received by the owner, based upon the plan of using the methods of shoring which contemplated interference with the adjoining building and carrying all shores to the basement, amounted to about twice the estimate on the scheme used, not counting the saving to the owner due to the elimination of interference with the tenants. The owner of the building is the Broadway-John St. Corporation; Deutsch & Polis, architects and engineers, 50 Church St., New York, designed and carried out the reconstruction and Drew Bros., New York, were the shoring contractors.

Road Culvert Checks Destructive Storm-Water Flow

New Design Prevents Erosion of Ditches and Farm Lands, Guards Against Washouts and Fills Gullies by Silting

PREVENTION of erosion of roadside ditches by storm-water, protection of roads and reclamation of waste land by the filling of wide and deep ditches, are the purposes of a concrete drop-inlet culvert now being used in Iowa. In some places heavy rains wash



ROAD CULVERT DESIGN WHICH PREVENTS EROSION

gullies in the land and enlarge the road ditches until they encroach upon the road and the adjacent farm land. At small bridges and culverts especially, the rush of water may cut away the slopes and narrow the road to a dangerous extent.

To check the velocity of the storm water, the standard culvert of the State Highway Department is made with a vertical intake shaft at its upper end. In times of storm, this causes a pool to form in which sediment will

DROP INLET PREVENTS RUSH OF WATER FROM THIS CULVERT AND CONSEQUENT EROSION

be deposited and the ditch gradually filled. The culvert is extended usually so that its inlet is near the fence or the right-of-way line. Farmers have sometimes paid the additional cost of extending it inside the fence line to prevent further cutting of the land and to cause the filling of gullies and washes which prevent cultivation of the land.

Construction of the drop-inlet culvert is shown in the drawing. Small drains at different elevations in the sides or end wall allow the water to drain off and thus prevent the formation of a stagnant pool, while the lower part of the ditch is silting up. In many cases the ditch has been filled to the top of the inlet shaft in one year. The fill for the road should be well tamped around the barrel of the culvert, and its top should be at least 3 ft. higher than the inlet, thus keeping the subgrade well above high-water mark.

The shaft is made the same width as the culvert, but in order to provide ample capacity, its length is made 12 in. greater than the width. Thus, on a culvert

CULVERT EXTENDED TO FENCE LINE TO FILL DEEP DITCH AND STRAIGHTEN ROAD

2 x 2 ft. the shaft will be 2 x 3 ft. As a rule, the shaft is built with its spillway 4 ft. below the grade of the road, and its face 6 ft. from the shoulder of the road, giving the fill a 1 on 1½ slope. A concrete slab covers the top, being supported by the outer corners and back wall which are carried 12 in. above the spillway for this purpose. Thus there are three inlet openings, the combined area of which is about 50% greater than that of the barrel of the culvert.

Access to the culvert for cleaning is provided by making the cover removable, but in no case has such work been found necessary. The cover is held in position by four 2-in. dowels at the corners of the shaft. As the concrete slab is poured in place, the dowels and the tops of the posts and back wall are covered with tarred felt to prevent bonding.

The beneficial results of this type of culvert are shown in the views which portray the inlet and discharge ends of a culvert 2 x 2 ft., 75 ft. long. This is in a high fill and replaces an old wood truss bridge. A vertical drop of 10 ft. 9 in. is given by the inlet shaft and the slope of the culvert gives a fall of 3½ ft. In less than a year the ditch on the upper side of the road had filled to the spillway, and it is stated that the

GULLY AT CULVERT INLET FILLED IN ONE YEAR

inlet could be raised to increase the drop to 20 ft. with benefit to the road and the adjacent land. In one view the wide ditch and caving land can be seen. In future the culvert will discharge only a steady, quiet stream, instead of one that is rushing and destructive. In another view, erosion has widened the ditch until the road is out of line and is still being attacked on its upper side, while piling driven for its protection has been undermined. With the drop-inlet culvert, this will be overcome by silting.

Culverts of the same general type, sometimes with pipe inlets, have been used before, in Iowa and elsewhere. This concrete drop inlet for culverts is the design of E. B. Hiatt, county engineer, Winterset, Iowa, who has already built a number of such structures with successful results.

Plans for Land Reclamation in Oregon

Plans for land reclamation to provide employment for munition workers, shipbuilders, returning soldiers in the reconstruction period, are urged by John H. Lewis, state engineer, Salem, Ore. A total of 1,183,000 acres in land is embraced in Oregon drainage and irrigation projects. Of this acreage 583,000 are in irrigation projects for which plans have been prepared by the state or Federal government, and 200,000 acres are in irrigation districts organized or in process of organization under the state irrigation district law. Mr. Lewis believes that the actual reclamation work should be done by private capital.

Urges Study of Unit Operation of Railroad Terminals in Large Cities

Yards and Terminals Committee, Railway Engineering Association, Presents Catechism, Recommends Investigation by Representative Committees of Possibilities of Coördinating Existing Facilities

PURSUING further its policy of attacking the emergency needs of the railroads, the yards and terminals committee of the American Railway Engineering Association in a special report now urges study of the possibilities of unit operation of railroad terminals in large cities. A statement of fundamental principles of unification of terminals and a recommendation for the appointment of representative committees to study the problems of each city is followed by a catechism which the committee believes "will suggest changes that will be fruitful of good results in any unification where local conditions are favorable." Appended to the report is an abstract of the address on unified operation of terminals made by John F. Wallace last April to the convention of the Chamber of Commerce of the United States (see *Engineering News-Record* of Apr. 18, p. 779), and papers on phases of the subject by H. J. Pfeifer, chief engineer of the St. Louis-East St. Louis terminal district, and E. H. Lee, vice-president of the Chicago & Western Indiana R.R. Company.

Fundamental Principles

Under the unification of terminals, states the report, are the following fundamental principles, which must be understood and applied:

1. A terminal is a clearing point and not a storage point for cars.

2. Each and every facility within the unified terminal limits must be considered absolutely a part of the whole plant. The word "facility," as used, includes "man power."

3. The use of each individual part must be coördinated with a view to its effect upon the best use of the plant as a whole.

4. Each individual operating organization must be coordinated and directed under one head.

The full application of these principles should give the most economical operation of the plant—by accomplishing the most expeditious and efficient movement of cars; by avoiding duplications, as in switching, clerical and other work, and of facilities; and by employing man power as well as physical facilities and mechanical power to capacity, where and when necessary.

As prerequisites to terminal unification, the following information should be obtained and analyzed:

1. A situation or key map on a small scale showing or indicating: (a) The entering lines; (b) the terminal facilities of each line; (c) the interchange connections and junction points of the lines in the district to be unified; (d) the location and capacity of yards; engine terminals, including coaling and water stations, cinder pits, sand houses and engine parking tracks; freight houses, transfer platforms and team tracks; (e) the location and track capacity of large industries and private warehouses.

2. Larger scale maps, indicating the facilities of each road, in sufficient detail, for critical study.

3. Topographical maps of the territory, where necessary.

4. Record of traffic handled by each line, divided: (a) As to local or through as referred to the district; (b) as to prevailing and possible routing; and (c) as to preponderance of direction of tonnage due to commodities and seasons.

5. Outline of present method of operation, considering: (a) General movement; (b) transfer or interchange movement, and (c) use of individual facilities, yards, engine facilities, freight houses, etc.

It is the thought that the investigation of and recommendation for any terminal unification should be made by a representative committee composed of representatives of all departments—transportation, engineering, mechanical and traffic officials, including, where complex situations are involved, at least two members from other locations than the terminal under study.

Catechism on Unit Operation of Terminals

In the operation of the unified terminal facilities, the load should be distributed evenly among all units so as to secure their constant normal use at the most intense efficient rate, coupled with avoidance of any excess peak load on any unit, treating both the individual carrier's terminal and the unified terminal always as a part of the railroads as a whole.

Certain captions under which improved conditions may be obtained by unification have been selected and, while constantly bearing in mind the fundamental principles first enumerated, questions are asked under each caption which will suggest changes that will be fruitful of good results in any unification where local conditions are favorable.

Interchange

1. Are you now handling maximum number of cars by the most economical or direct route, either existing or reasonably attainable?

2. Can the number of interchange movements be reduced advantageously by combining movements from various origins to various destinations?

3. Can you extend the practice of reciprocal interchange now working so advantageously at many points?

4. Are you interchanging directly between yards instead of on assigned interchange tracks? Could not delay and rehandling be reduced by so doing?

5. Are you, as far as practicable, making interchange with regular crews familiar with the routes and the work to be done?

6. Can volume of direct interchange be increased by minor track changes or changes in practice?

7. Are interchange facilities at any point inadequate for periods of heavy traffic under new conditions, and, if so, is it practicable at reasonable cost to make necessary increase of capacity, or is it better by rerouting interchange to relieve the situation?

8. Have you any separate route of interchange that could be discontinued to advantage by consolidation with another route?

9. Can you have cars grouped, either in cuts or solid trains, before they reach the terminal, so as to reduce terminal switching?

10. Can interchange in any terminal be reduced to advantage by rerouting through outside junctions?

Consolidation of Industry and Team-Track Switching

11. Have all industrial plants sufficient track capacity and other facilities so that cars may be promptly placed, loaded or unloaded to the full capacity of the plant during each working shift without unduly frequent switching or interference with plant operation?

12. Can you arrange for "one line" switching of individual or grouped industries or team tracks?

Consolidation of Yards

13. Can greater efficiency in yard operation be obtained through the consolidation of the yards of one or more railroads:

(a) By dividing large terminals into zones and assigning as great a number of receiving yards to as small a number of classifying yards as possible, thereby assembling the maximum number of cars into the minimum number of classifications?

(b) By pooling similar yards of neighboring railroads so as to conserve yard room, avoiding both the duplication of switching and interchange between yards?

(c) By consolidating existing facilities, adapting such combined facilities to a new program of operations which disregards prior uses, with or without minor physical changes; or by pooling the same in the sense that one line's facilities are used to serve the overflow of traffic confronting a neighboring line's facilities?

(d) By combining the use of two or more yards to adapt them to the segregation of freight with respect to commodities or destinations?

Consolidation of Engine-Terminal Facilities

14. Can you re-assign or coördinate the use of engine-terminal facilities so as to avoid or reduce delay and congestion, reduce expense and engine miles, or improve supervision?

15. To what extent can neighboring engine-terminal facilities be adapted to the economical housing and handling of engines grouped according to the nature or location of their service or their size without regard to road ownership?

Consolidation of Car Inspection

16. Has "single inspection" been instituted wherever cars are interchanged?

17. Can greater efficiency be obtained by consolidating the car inspection forces at adjacent yards, junctions or stations?

18. Are car inspections and repairs so made as to insure safety and prevent further damage to equipment and lading?

19. Is such inspection made so as fully to detect violations of loading rules, and are these rules effectively enforced in every case of such violation?

20. Has the force of inspectors been *educated* to the making of effective inspection, and is the inspection followed unremittingly by the making of adequate repairs?

Consolidation of Car-Repair Work

21. Can you obtain greater efficiency through extending consolidation of car-repair forces and facilities: (a) By combining in one repair yard the work of one or more roads? (b) By combining the forces and facilities in a given zone?

22. Do you require car inspectors at outlying points to repair cars as far as possible and to make light repairs to cars in industrial districts where cars are "made empty" or placed empty for loading?

23. Are you keeping maximum number of cars in service by giving preferred attention to those needing light repairs?

Consolidation of Car Records

24. Can the number of records and incidentally the amount of clerical work be reduced:

(a) By the consolidation of car-record departments?

(b) By the consolidation of car-record forces in yards reasonably near, one to the other, whether these yards are combined or not?

(c) By the elimination of certain intermediate car records on each road through a more comprehensive and manifold use of train and yard reports so as to supply the greatest amount of information from each report?

Consolidation of Freight-House Facilities

25. Can the freight houses of two or more lines be so combined that certain houses may be used for inbound and others for outbound business?

26. Can the use of a freight house be discontinued, transferring its business to another or to a combination of other freight houses?

27. Can certain freight houses be assigned to designated commodities (perishable or non-perishable)?

Transfer of Freight Between Freight Houses

28. Are you preventing transfer of freight between freight houses:

(a) By loading more intelligently at originating points?

(b) By utilizing more fully in both directions drays, tractors, trucks, tunnels, or other means of conveyance, so as to reduce the use of trap cars and save rehandling?

Consolidation of L.C.L. Business at Terminals

29. Are you coördinating: (a) the routing of L.C.L. freight, (b) the use of freight houses at either end of the route, (c) the use of transfer stations, to avoid (1) congestion, (2) unnecessary local transfer of freight between houses, (3) light loading of cars?

30. Have you adopted "sailing days" for L.C.L. freight: (a) To secure better and heavier loading of cars, (b) to avoid breaking bulk in transit, (c) to reduce loss and damage in transit, (d) to avoid "overs and shorts" by such stowing in the car as to make individual shipments readily accessible in "peddler" cars at intermediate stations?

31. What may be done in the way of extending railroad service to include "store-door delivery" of freight?

CONSOLIDATION OF TEAM TRACKS

32. Can team tracks in reasonably adjacent territory be consolidated and thus bring about, (a) reduction in classification, (b) more intensive use of valuable terminal property, (c) more prompt release of cars, (d) greater convenience to the public, (e) avoidance of a needless duplication of operation or maintenance, (f) the use of yards near passenger stations for baggage, mail and express when desirable?

BUREAU OF COLLECTION OF FREIGHT CHARGES

33. Where collection of freight charges is necessary at other than stations, have you given consideration to (a) collection for all railroads by zones as a matter of economy and public convenience, (b) collection for all railroads from all sources by a designated bureau?

CONSOLIDATION OF WHARVES, DOCKS AND ELEVATORS

34. Can you obtain greater efficiency in the use of waterfront facilities of one or more railroads by consolidation of (a) coal piers, (b) grain elevators, (c) merchandise piers, (d) other piers so as to (1) reduce number of units operated, (2) take full advantage of most modern facilities to reduce double handling of freight, (3) release facilities for other uses, (4) reduce switching or floatage, (5) secure more prompt release of cars?

35. Will beneficial results follow the placing of all waterfront facilities, or those in certain zones, under single control?

CONSOLIDATION OF PASSENGER-STATION FACILITIES

36. Can you obtain greater efficiency in operation through extending consolidation of the passenger facilities of one or more railroads:

(a) By combining forces of two or more lines using the same station?

(b) By using one or more stations for handling the business of two or more lines, thus enabling certain stations to be closed?

(c) By coördinating the use of stations so as to handle in the same station the traffic from or to certain regions?

(d) By continuing the use of adjacent stations, but consolidating their forces?

(e) By abandoning passenger service on certain sections of a line, the traffic affected to be accommodated on other lines?

CONSOLIDATION OF PASSENGER-STATION SWITCHING

37. Can you obtain greater efficiency in operation through extending the consolidation of passenger switching:

(a) By combining the switching of two or more roads, using the same station, where each now performs its own switching?

(b) By combining the switching operations of adjacent stations?

(c) By extending any existing joint service to include all switching operation of passenger equipment within the terminal?

(d) By reassigning coach yards so as to reduce haul of equipment to a minimum and to obtain maximum efficiency?

38. Can an existing freight or other yard and terminal be converted into a purely passenger facility, effecting economy, reducing congestion in both freight and passenger traffic, and decreasing haul of empty passenger equipment?

39. Can you use wye tracks or loops for turning trains?

CONSOLIDATION OF TICKET OFFICES

40. Are city ticket offices, other than at stations, so consolidated that all tickets for each road are sold by each ticket clerk?

41. Are ticket forces now consolidated at stations used jointly?

42. Can ticket forces of adjacent stations be consolidated to advantage?

43. Have you analyzed the necessity of continuing city ticket offices outside of stations?

44. Have you analyzed the ticket sales in the office to develop the relative number of tickets sold to a certain few heavy traffic destinations, with a view of improving the service by confining the sale of such tickets to one or more windows?

45. Have you considered at depot ticket offices the limited consolidation of sale of railroad tickets to heavy traffic destinations, with the general sale of Pullman tickets, to improve service to the public: (a) By avoiding the sale of excess railroad fare, for privilege of riding in Pullman cars, to passengers who may later be unable to secure Pullman space? (b) By avoiding delay to passengers at ticket windows? (c) By retaining simplicity and accuracy in the internal work of the ticket office, through limiting access to the diagrams to isolated and the fewest possible regularly assigned clerks —whose duties are to mark reservations and both to handle and check cancellations—and providing telephone or other communication between them and window clerks?

CONSOLIDATION OF TELEGRAPH OFFICES

46. Can you obtain greater efficiency in the use of telegraph facilities of two or more lines: (a) By further consolidation of adjacent offices? (b) By using offices of one line in handling trains on an adjacent line? (c) By through routing of messages? (d) By consolidating or coördinating relay offices? (e) By a more general use of the telephone, telautograph, automatic telephone, or other means of transmission; attracting attention by visible or audible signals?

CONVERSION INTO MULTIPLE-TRACK SYSTEM

47. Can you convert two or more single-track lines into a multiple-track system, establishing currents of traffic, to expedite train movement; to increase safety, capacity and train tonnage; and to promote economy?

SEGREGATION OF FREIGHT AND PASSENGER TRAFFIC

48. Have you considered the possibility of consolidating the passenger traffic of several lines, now carried over three or more main tracks, upon two main tracks:

(a) For the purpose of providing a better entrance to a passenger station?

(b) For the purpose of setting free badly needed tracks for use in freight service?

(c) For the purpose of securing freedom from inter-

ruption by passenger train movements of freight, transfer or switching movements?

Roadway and Structures

49. Have you, with the intensified use of terminals, made proper arrangements for the maintenance and improvement of all yard and main tracks and structures to such standards as will render them reliably serviceable under the new conditions?

50. Are there limitations of curvature, clearances or other conditions that may interfere with plans of unification in any case?

51. Are the terminal buildings located and so maintained that the maximum efficiency of the terminal operation may be attained?

52. Are trains delayed on account of inconvenient or remote locations of billing offices?

53. Are terminal buildings reasonably accessible to the homes of employees? How should this condition be improved?

54. Are proper conveniences in the way of rest rooms provided for female employees; and are the buildings properly lighted, ventilated and heated?

"Catechism of Yard Design and Operation"

55. Are you familiar with the pamphlet entitled "War Emergency Yard Improvements" of the American Railway Engineering Association, issued February, 1918, and are all of the recommendations therein contained being observed in your terminals?

56. Would not familiarity with the "Catechism of Yard Design and Operation" contained in that pamphlet result in increased efficiency?

57. Should not a copy of that pamphlet be placed in the hands of each official and employee concerned in yard operation?

Economies of Consolidation

To illustrate the advantages of consolidation of facilities, H. J. Pfeifer, in his monograph on the subject, points out that if two roads are so close together that the trains of one can enter the yards of the other with little extra expense, the assigning of the yards of one for inbound and the other for outbound movements will reduce the number of classifications 50%, and as a consequence the number of cars assembled in each classification in a given time will on the average be doubled. If six, nine or more lines consolidate in groups of three each, the ratios of classification and number of cars in each classification become 1:9 and 9:1 respectively, and with groups of four, 1:16 and 16:1. If a given car movement is handled through five yards, there will be 16 times as many cars in each transfer between yards in a given time as if the same volume of traffic were handled through 20 yards.

The economies in time and expense resulting from such a consolidation of yards, eliminating one or more intermediate classifications, says Mr. Pfeifer, are many and varied, resulting in a saving of car days, car damage, extra switching expense, locomotive hours and many other sources of delay and expense. The money value of these savings depends, of course, on the size of the terminal and the reduction in complexity of service it is possible to bring about through yard consolidations. That it will involve savings in time and expense aggregating a value of millions annually in some of the larger terminals is not an unreasonable expectation.

Principles for Moving Cars Through Terminals

As the movement of a car through a terminal, or over a road, is governed by its destination, regardless of its origin, the following general principles governing the expeditious and economical movement of freight cars through a large terminal, are suggested:

1. The train being the unit in which car movement is conducted between two points, cars moving to common points should be got together at as early a stage in their movement as possible, and kept together as long as possible. Therefore, if two or more lines come into a terminal from the same general direction their trains should enter a common yard, so that cars moving to common points in the terminal can be put together.

2. As cars can be kept more closely together in a small group of yards, the number of classifying yards should be maintained at the minimum, consistent with the movement of cars by reasonably direct routes.

3. As a given number of cars will accumulate in trains of proper size to be moved more rapidly with a small number of classifications, the minimum number consistent with securing the required separations should be used.

4. As intermediate switching involves loss of time and extra expense, car movement should be consolidated as much as possible to reduce it to a minimum.

Intermediate Transfer Railroads

E. H. Lee, discussing the operation of intermediate terminal transfer railroads, particularly those which operate trains with their own power and crews, set forth principles and reasons therefor which, condensed, are as follows:

1. The operation of transfer railroads should usually be restricted as much as possible to the transfer of cars as distinguished from the classification of cars. The through line should so far as practicable deliver its cars to the transfer line classified and straightened out into cuts for the various through lines to which deliveries are to be made by the transfer line for through line account. The main tracks of most transfer railroads are ample for a larger volume of traffic than is handled over them, but in times of congestion they are frequently blocked at junction points, yard entrances and connections by trains which are unable to get into yards by reason of their crowded condition. These yards, in turn, are congested by an oversupply of cars awaiting classification, which occupy room which should either be reserved for the receipt of main-line transfer trains or which should be kept for the classifications which are necessary and which cannot be made to advantage elsewhere.

The place to control congestion is at or near the various points where business originates. By proper measures the through line may in a degree control congestion in its own important terminal yards, by holding back business, something impossible to the belt line, without the help of the through lines.

Business moving even in heavy volume is not congestion, and where they exist, belt lines if kept reasonably open and uncongested are the best means of keep-

ing cars moving in terminals, thus avoiding congestion and blockades.

KEEP FOREIGN POWER OFF BELT LINE

2. Where transfer or belt roads are of considerable length and equipped with motive power to handle transfer trains, it is the better practice to keep foreign engines off the belt line, performing the transfer service with belt crews. Better supervision can be secured where train crews are kept at home. It is difficult, if not impossible, to enforce discipline over crews while operating on a foreign road (particularly against loafing on the job), even though in theory they become the employees of that road while so engaged. Moreover, discipline and standards of performance differ on different railroads, being better on some and worse on others. Where foreign trains and engines operate over a transfer road it ordinarily happens that the general movement is regulated by the slowest and most indifferently operated train. There is also a difference in the standard of power maintenance as between railroads. A stalled train caused by the engine breaking down, not steaming or being overloaded, delays all following trains, and if the crew is foreign, the railroad officers who should apply discipline have no direct stake in the failure, and find excuses ready to hand.

3. Trains should be so made up that one engine will handle as many cars as far as possible. This principle is used in the operation of through lines very generally. Under the new Federal operation trains of war material have been consolidated and run solid over several different railroads without breaking up, with a saving of time and expense. The application of the principle on transfer railroads is even more important than on the through lines, because it is one of the best ways of reducing dead time.

DELIVERIES

4. Where track facilities permit, the through-line engine should make deliveries to the belt-line yard and should haul back its own deliveries from the belt-line yard. This eliminates light running. It also fixes responsibility, something of great importance during times of congestion, because it permits the prompt application of the remedy. This presupposes that the belt line has sufficient tracks for both its receipts and deliveries, which will doubtless be true in most cases, where its yards are kept properly clear. As the receiving road controls its own receipts, this arrangement would give control of both receipts and deliveries to the belt line, because unless the through line keeps its receiving tracks clear by taking its business, the belt line can shut it off, and this is as it should be.

5. Transfer trains should be loaded to capacity so far as practicable, because a light train costs about as much and occupies the track facilities to about the same extent as a full train, while handling less cars.

Three things which it is believed would have especial effect in controlling congestion are the construction of storage yards outside the terminals; the advance classification of transfer cars to the greatest practicable extent; and an extension of the authority of the men in charge of terminal operations, whatever their rank or title, in order that they may better control the flow of traffic to and through the terminals.

Lay Down Lines of Organization for Contractors' Association

Objects of New National Body Are Broad in Scope—Contractors' Committee to Build on Local Association Idea

AGREEING that conditions growing out of the war have made a national organization which would serve the general contractor an imperative necessity, the temporary committee which met in New York Sept. 23-24, as noted on page 604 of this journal last week, proceeded to lay down the broad principles on which such an organization must be built, and to call a convention of contractors and contractors' associations to make the national association a reality.

After a discussion which lasted, with a few hours' intermission for sleep, from Monday morning until Tuesday night, and in which consideration was given to written opinions expressed by almost every one of those unable to attend, the committee reached a number of conclusions as to the possible lines of action for such an association, set forth in the minutes of the meeting as follows:

"There is immediate and great need for a national organization of contractors. There should be included in such an organization all general contractors, whether engaged in building, heavy construction, highway, railway or other branches of engineering construction work. There must be excluded from such an organization all men who supply construction materials or equipment and all subcontractors, defining as subcontractor one who contracts with general contractors to perform the work required on the part of one or two trades.

MEMBERSHIP BY ASSOCIATIONS

"Membership in such an organization must be by national, state, local or sectional associations of general contractors, where such exist or can be formed, and the formation of such associations where they do not exist must be one of the chief concerns of the national association, since many reforms can only be obtained through local concerted action on the part of all the contractors concerned, and such action can be obtained only through local associations. Until, however, such associations can be formed, contractors should be admitted as individuals to the national association in territory where there is no available local association.

"Such an association could be of great assistance to the Government in the present emergency in providing additional construction organizations, if needed, and especially in taking upon itself the burden of proof regarding construction and building work which might go forward without hampering war work, and which would contribute to the strength and efficiency of the nation.

"Such an organization could exert great influence to secure better contract practice and to relieve the contractor of unnecessary risks both at present and in normal times. Such an organization could exert great influence to eliminate undesirable practices in the letting and conduct of work on the part of owners and engineers.

"Much could be done toward eliminating from public

work both undesirable politics and antiquated contract methods

."The labor problem could be dealt with and developed in a comprehensive manner on a national scale, so as to avoid an open and disastrous war with organized labor, and at the same time eliminate trade union practices that are bad for both men and employers, and so as to increase the efficiency and standing of construction workers.

"There is an opportunity for such an organization greatly to improve business methods between owners, contractors, material men and equipment makers. Such an organization would be a powerful instrument for improving the standing of contractors in the business world and eliminating the undesirable and inexperienced from the field.

"Such an organization could coördinate the efforts of local associations of contractors so that it would be possible to realize local reforms which cannot now be made because outside contractors are free to come in and prevent the taking of concerted action on a question by refusing to coöperate.

"The general level of efficiency on construction work could be steadily raised through such an organization by eliminating methods of doing work in which the efficient performance of the work is lost sight of in making profits on investments, securities and other business features connected with the project."

To carry these ideas into effect through a permanent national organization, to be known as the National Association of General Contractors, a constitution was drawn up which will be submitted to the convention called to meet in Chicago Nov. 20-21. The proposed constitution is based on the idea of accomplishing reforms through the activity of a strong central organization, backed by ample funds, in coöperation with active local associations of general contractors. The proposed constitution is given below:

Section I—Name

The name of this association shall be the National Association of General Contractors, hereinafter referred to as the association.

Section II—Purposes

The objects of the association are to promote better relations between private owners and public bodies and their architects and engineers on the one hand, and contractors on the other; to maintain high standards in the conduct of construction work; to combat unfair practices; to encourage efficiency among contractors, to support contractors and contractors' associations in efforts to rectify construction conditions of an unsatisfactory character; to encourage those methods of contracting for work which relieve the contractor of improper risks, and to encourage sound business methods tending to raise the standing of contractors generally in the business world.

Section II-A—War Service

1. The association shall endeavor to focus on the construction problems raised by the war the resources of contractors, and to coöperate with the Government to distribute work required in the best manner.

2. The association will also endeavor to collect facts regarding non-war construction work which will show whether materials and labor can be obtained without affecting the war program.

Section III—Membership

1. Members of the association shall be national, state or local organizations of general contractors, or individual firms engaged in general contracting where there does not exist an available association eligible to membership. Members of associations must be general contractors in order that said associations may be eligible to membership in this association.

2. The term "general contractor" is understood to mean a contractor or contracting firm engaged in construction work which undertakes and carries out, at least partly with its own forces, construction operations of any description in their entirety.

Section IV—Administration

1. All affairs and activities of the association shall be conducted by an executive board of 15 elective members and of the three elective officers of the association, who shall be a president, a vice president and a treasurer.

2. The executive board shall hold two regular meetings each year, at times and places to be determined by it. At these meetings all regular business of the association shall be considered.

3. Special meetings may be called by any two of the elective officers of the association.

4. The president of the association, or, in his absence, the vice president, shall preside at sessions of the executive board.

5. The president and executive board shall employ a paid secretary, who shall have a close acquaintance with the contracting business. The secretary shall conduct the general offices of the association, which shall be located in Washington during the remainder of the war. He shall be empowered to employ the necessary office staff and to conduct the business and further the objects of the association. His compensation and the expenses to be incurred in maintaining the offices shall be determined by the executive board.

Section V—Elections

1. Officers of the association and members of the executive board shall be elected at the annual convention to be held the third Tuesday in January.

2. Each member association shall be represented at the annual convention by one duly authorized voting delegate for every ten members in good standing; but no such association shall have less than two voting delegates in the convention.

3. Any 10 individual contracting firms, members of the association, but not of any member association, may designate one of their number as their delegate to represent them with one vote in the annual convention, under rules to be prescribed by the executive board.

4. The president, vice president and treasurer of the association shall be elected annually.

5. One-third of the members of the executive board shall be elected at the first annual convention for a term of three years, one-third for a term of two years,

and one-third for a term of one year. At each succeeding annual convention new members shall be elected for a three-year term to replace those whose terms expire. Vacancies shall be filled until the next annual convention by the executive board.

6. Any member of the association or of one of its member associations is eligible to office or to membership on the executive board; but no person who is a paid officer of a member association shall hold office in the association or be a member of the executive board.

SECTION VI—DUES

The dues of the association shall be for each individual member firm $50 annually and for member associations, $10 annually for each member of such member association at the beginning of the year in which the dues are paid, with a minimum for each association of $100 per year.

SECTION VII—AMENDMENT

This constitution may be amended at any annual convention by a two-thirds vote of the duly constituted delegates registered at the convention.

Government's Mississippi Barge Fleet Now Building

Steel Tow-Boats 300 Feet Long and 48 Feet Beam Designed To Carry 3000 Tons at High Water and 850 Tons at Low Water

NINETEEN steel barges and four steamers to tow them comprise the upper Mississippi River barge fleet, contract for which has been let at $3,360,000. Plans for the barges and boats have now been prepared by W. S. Mitchell, assistant engineer, in charge of the United States Engineer Office in St. Louis. In the July-August *Journal* of the Engineers' Club of St. Louis, Baxter L. Brown, consulting engineer, gives the following details.

The barges had to be so designed that they could carry economically large tonnages of low-class bulk freight like ore, coal, steel and lumber, or oil. The limiting navigable draft during the low-water season in the upper Mississippi River is 4 ft. for a wide tow. The limits of length and width were imposed by bridge spans and locks. There are 14 bridges between St. Louis and St. Paul; all but one of the bridges have clear spans of at least 150 ft., through which three 48-ft. barges may be passed abreast. There are two locks, at Keokuk and at Moline, and there soon will be three, as an additional lock is being constructed on the Upper Rapids at Smith's Island, a few miles above Moline. The clear length limit at the present Moline lock is 300 feet.

The problem, therefore, was to design craft which should handle upstream tonnage against rapid currents, and could be operated profitably on a depth of 4 ft. in time of low water in a country whose rail transportation is on a lower ton-mile basis than that of any other country in the world. These barges will be 300 ft. long, 48-ft. beam and 10 ft. deep, with 8- to 9-ft. full load draft. They will be double enders, with modified spoon bows. Such a barge will carry 3000 tons on 9-ft., and 850 tons on 4-ft. draft at time of low water. A tow with three such barges, which is the best approved arrangement for a river towboat, would thus carry 9000 tons at high water and 2500 tons at low water.

The barges will be built with open cargo hoppers, 36 ft. wide by 256 ft. long and 6 ft. deep, with the bottom 5 ft. above the bottom of the barge. The hopper will thus leave a 6 ft. deck on each side of the cargo space, which will be surrounded by a raised coaming. As the barges will be equipped with pipes and pumps they may carry oil in the double bottoms. The situation of the great oil fields of southern Illinois and Louisiana relative to the Mississippi River makes this a desirable feature.

The fleets to be constructed under these plans will have a wider range of operating possibilities than any other river craft ever designed at home or abroad, and will operate profitably on even the minimum draft allowed. The barges will be pushed, as on the rivers of the Mississippi Valley, or may be towed tandem, as in Europe. They may be loaded with oil or with heavy bulk freights, or any other commodities that may be carried without protection from the weather.

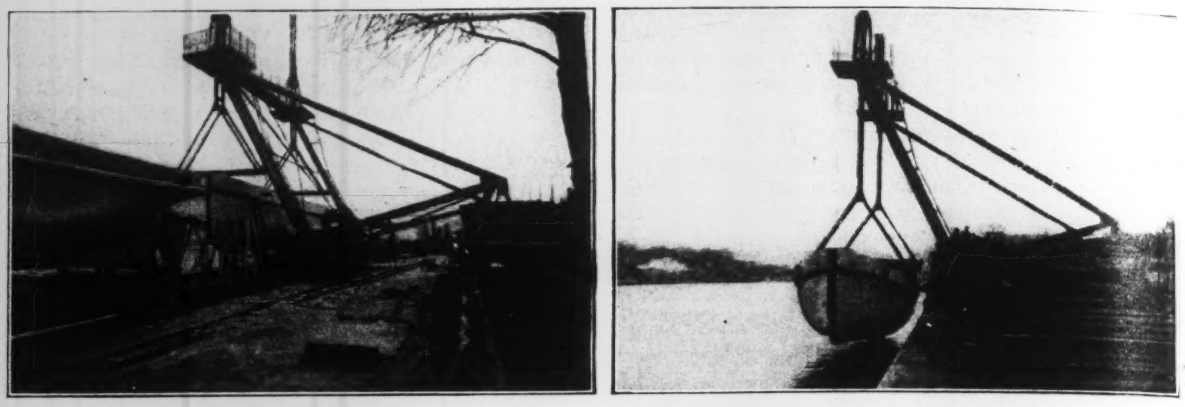
The upper Mississippi is a reach of river 675 miles long. The available depth of channel during the high-water months is 7 to 9 ft. The channel is relatively stable, as the river carries but little shifting sand. The stream runs through an agricultural region of great richness, but the traffic possibilities of immediate importance arise from the fact that at its upper end is a district entirely without coal, yet possessing the richest iron mines in the world, and two industrial cities having together considerably more than 500,000 inhabitants; while at its lower end is an inexhaustible field of excellent steam coal and the fourth manufacturing city in the United States.

French Concrete Tugs Launched by Swinging From Cranes

Quantity Production of Small Seagoing Boats Now Under Way in Yard at Paris on Bank of the Seine

SMALL reinforced-concrete tugboats of a total deadweight carrying capacity of about 80 tons are being built in quantity production in the yard of the Pelnard-Considère-Caquot Co. in Paris, for the French Government. The tugs will be used in harbor and river work to piece out the usual wooden and steel tug production, which has been very much reduced on account of the war. While designed largely for still water service, they are assumed to be seaworthy for the open ocean. No small part of the speed of production is due to the simple method of launching shown in the photographs reproduced herewith.

The yard is on the quay wall of the Seine River, and the boats are built some 20 or 30 ft. from the edge of the wall. Back of the boat is a track or a pathway on which rolls the double-member balanced crane shown in the view. This crane consists in effect of two shear legs spaced some 30 ft. apart and thoroughly crossbraced in the plane of the front masts. They are balanced by a counterweight, made up of a reinforced-concrete box which is filled with stone to provide the proper weight. Dependent from the top



EIGHTY-TON CONCRETE TUGBOATS LAUNCHED BY CRANE FROM BANK OF THE SEINE

of each mast is a hanger working in a jackscrew at the top and provided with a spread grip at the bottom which can be carried around the hull of the ship. When the ship is to be launched the crane is moved up to it on the longitudinal roadway and the boat is fixed in the jaws of the hangers, and the crane is then moved transversely on rollers until the boat overhangs the river, as shown in one of the views. The jackscrews are then lowered until the boat is in the water. The jaws are released after the boat is afloat.

The tugboats are provided with Diesel engines of 300 hp. They are 82 ft. long and 16 ft. wide and draw 6 ft. of water. The views shown herewith were given in *Le Génie Civil.*

Consolidation of Texas Railroads Under Federal Operation

BY A FORMER GENERAL MANAGER

FOR THE purposes of Federal operation the Texas railways have been divided into three Federal managers' districts: (1) The Southern Pacific-Gulf coast lines group, including: (a) Galveston, Harrisburg & San Antonio, (b) Texas & New Orleans, (c) Morgan's Louisiana & Texas, (d) New Orleans, Texas & Mexico, (e) St. Louis, Brownsville & Mexico, and (f) San Antonio & Aransas Pass; (2) Texas & Pacific-International & Great Northern group, including (a) Texas & Pacific, (b) Louisiana Railway & Navigation Co. (west of Mississippi River), (c) St. Louis Southwestern Ry. of Texas, (d) International & Great Northern (except line from Spring to Fort Worth, Texas, and Madisonville branch), (e) Missouri, Kansas & Texas Railway of Texas (Trinity branch), and (f) Beaumont & Great Northern; (3) Gulf, Colorado & Santa Fe-Frisco-Katy groups, including (a) Gulf, Colorado & Santa Fe, (b) Fort Worth & Rio Grande, (c) St. Louis, San Francisco & Texas, (d) Texas Midland (e) International & Great Northern (Spring to Fort Worth, and Madison branches), (f) Missouri, Kansas & Texas Ry. of Texas, (g) Wichita Falls & North Western, (h) Fort Worth & Denver City, and (i) Houston & Texas Central. The amalgamation of the Texas lines is perhaps the most extreme case in the country of operating a number of distinct lines under one management, many of which have no relation one with the other, and in some instances former through lines have been separated or dismembered and placed under separate managements.

The Texas laws require all trunk lines having mileage within and outside of that state to maintain separate and complete organizations covering the lines in Texas, and headquarters must be maintained in that state. This requirement in the past has caused the Texas through lines much expense and inconvenience. Federal operation has met this requirement by locating its officers in the state of Texas. The question arises, Will the combination of lines in the state of Texas under Federal management produce greater efficiency and economy in operation?

It has always been the opinion of experienced railway men that one reason for the lack of greater efficiency in the operation of railways is the limited supervision obtaining on certain roads. If this is true, then the situation has not been improved by the present grouping of Texas lines, the extension of territory under one management and the separation and dismemberment of lines, placing them under new organizations unfamiliar with their operation.

It might have produced greater efficiency if the main trunk lines had not been disturbed, but made the nucleus of a Federal operating district to which the smaller lines could have been added, also intact, as feeders or branches. In this manner the integrity of the trunk lines would have been maintained and the operating staffs familiar with them would obviously secure greater efficiency in their operation than is obtainable under a system of separation, dismemberment and a new and untried organization.

Looking forward to the eventual return of the railways to their owners after the war, intact and in substantially the same condition as before they were taken over by the Government, prudence would seem to suggest that some regard be given to the original identity of the respective lines, thereby reducing confusion and business disturbance, with perhaps less expense to the Government.

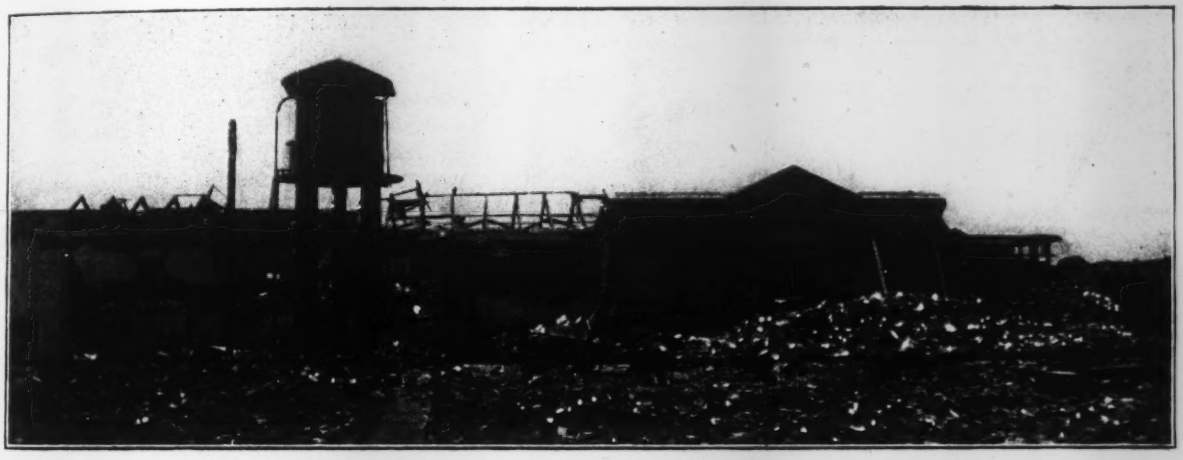
It is absolutely necessary that anything and everything be done toward the main object—the winning of the war—and this can best be done by promoting efficiency and economy in all activities. Is this result being accomplished in the manner in which the Texas railways have been grouped under Federal operation, and have the foundations been laid to accomplish the great considerations of increased efficiency and economy—the two most essential elements in war activities?

Guatemala Earthquakes Destroyed All Masonry Buildings

Wood and Concrete Frames Stood Shocks Well—Wrecked Sanitary Services To Be Rebuilt Under the Direction of Red Cross Engineers

BY EDWARD STUART
Sanitary Engineer, American Red Cross Guatemala Relief Commission, 106 Strathcona Hall, Cambridge, Mass.

MASONRY buildings, of the almost universal type used in South America, were practically without exception destroyed in the severe earthquakes that shook Guatemala City last December and January. Framed structures, whether of steel, wood or concrete, suffered little damage except in the shaking off of the applied surfacing. Engineers of the American Red Cross, sent to the city soon after the disaster, were able to inspect the destroyed structures and also to report on the reconstruction not only of the buildings but of the sanitary services, which were seriously damaged.



CONCRETE WATER TANK INTACT. MASONRY HOSPITAL DESTROYED BY EARTHQUAKE

Guatemala City, the capital of the Republic of Guatemala, was violently shaken by three great earthquakes on Dec. 25, 1917, and Jan. 3 and 24, 1918, Between these dates there were many minor shakes, on some days occurring hourly, and for months afterward vibrations of varying violence passed through the city. There were shocks even as late as June 1. The three large earthquakes destroyed 95% of the buildings, throwing the walls into the streets and destroying the houses, with a considerable loss of life and an enormous loss of homes and property. About three hundred lives were lost at the first great shock, and the continual vibrations destroyed more and more of the buildings, rendering the entire population of 120,000 homeless, and producing a disaster of large proportions. The water-supply systems were broken, the normal food supply was interrupted, the railroad was damaged, preventing the inhabitants of the city from leaving for other points, and serious sanitary conditions arose as a result. The greater portion of the people built little shacks and leantos, of lumber rescued from the wreckage, in all the squares, parks and around the edge of the city; and, demoralized by the continual quakes, they waited resignedly for the earth to open or for an enormous volcanic eruption.

As soon as practicable the American Red Cross ordered a shipload of foodstuffs, amounting in value to $110,000, sent from Panama to San José, the Pacific port of Guatemala; and the United States War Department sent 4000 army tents for the shelter of the refugees. A commission was sent from Washington to administer relief and give medical and sanitary aid.

The city lies on a large plateau 5000 ft. above sea level on what may be considered the continental divide, part of the run-off flowing to the Pacific, the remainder to the Atlantic Ocean. More than 150 years ago the former capital of the country, Antigua, on a neighboring plateau, was destroyed by an earthquake, and a different site was selected for the new capital, Guatemala City. It was thought at that time that the new site would be protected against earthquakes by the great ravines which surround the city. The great ridge of mountains running through North and South America, from Alaska to Patagonia, is especially active volcanically in Central America, and earthquakes are frequent, the largest recent shocks being one at Quezaltenango, Guatemala, in 1902, one at Cartago, Costa Rica, in 1910, and one in San Salvador in 1917. In this section they are very often followed by volcanic eruptions, as in the cases of the first and third mentioned above, and it is greatly feared that the volcano, Pequaia, 15 miles from Guatemala City, will erupt some time this year.

The recent Guatemala earthquakes were very variable in character, consisting of vertical, longitudinal, transverse or S-shaped, and long surface waves, some violent and others slow and gentle, with long-continued after-

shocks. It is therefore not surprising that, with such a variety of movements, great destruction resulted in the city. The Government seismograph was destroyed at the first great shock, so that there are no local records of the earthquakes. However, complete records of the

RAILROAD CARS OVERTURNED BY EARTHQUAKE —STEEL FRAMES IN REAR INTACT

earthquakes were obtained in North America and are recorded at the Harvard, Cornell and Ottawa stations; and some of the waves traveled across the Atlantic, as Barcelona, Spain, recorded some of them. The shocks apparently were not recorded across the Pacific Ocean. Although the damage in the city was great, and the disaster considered of large proportions, we cannot exactly class this as a great earthquake, geologically, as otherwise the shocks would have been felt around the world; moreover, the cities on the other plateaus of Guatemala were not damaged, although the shocks were felt. The writer was present during the third large shock, which occurred on Jan. 24, and, with other engineers who were in the city at the time, is of the opinion that the maximum displacement of the ground produced by the vibrations was about 12 in. The general direction of the waves was east and west. They produced an interesting effect upon the stone benches in the parks, those placed with the long axis in a north-south direction being overturned, while the east-west benches remained standing.

Practically all construction was of masonry, which, as has been observed in previous disasters of similar character, is least suited to withstand the shocks. The masonry walls were rocked back and forth the heavy cornices falling, and then with great crashes fell into the streets or collapsed into the interiors of the buildings. The heavy tile roofs, so common in the tropics, were all shaken down. More numerous than brick or stone were the buildings of adobe (large sun-dried bricks of clayey mud, with straw as a binder). Buildings of this character were in nearly all cases leveled to the ground, forming large masses of débris all over the city. The adobe, partly pulverized, was the source of enormous clouds of dust which caused much eye infection. Walls of stone and brick withstood the shocks badly, the damage increasing in proportion to the poorness of the mortar, which usually is very bad, the high cost of cement in the country discouraging the use of cement mortar. However, masonry walls with heavy buttresses and walls battered on both sides, even with poor mortar, were but very slightly damaged.

Buildings of wood construction alone remained standing practically intact, except where they were injured by falling walls or chimneys. There were, however, very few buildings of this kind, and consequently no fires resulted from the earthquakes. In fact, fires are so infrequent at any time in Guatemala that absolutely no provision has been made for protection against the spread of fire in the city.

Another form of construction is "bahareque," rough wooden framing bound together with bands of cane, and plastered inside and out with mud. Such houses remained undamaged, except that the greater part of the mud plaster was shaken off, and where the roof was covered with tile the roof framing usually collapsed.

There were no modern structures of reinforced concrete with the exception of one building, a residence of two stories, just completed, and now the home of the British legation. This has small reinforced-concrete columns, with walls 4 in. thick reinforced with expanded metal; the floors, stairs, balconies and balustrades were of similar construction, and a large amount of filigree cement work, reinforced, is around the cornice. This building remained intact, not one crack appearing; it gives us additional evidence of the value of reinforced-concrete construction in earthquake regions. Another example is furnished by the water tank at the General Hospital, which was set upon long 8 x 12-in. reinforced-concrete columns, which were not even cracked, although the surrounding structures, all of heavy masonry and brickwork, were entirely destroyed. An accompanying photograph strikingly shows the contrast.

The railroads suffered principally from the many landslides occurring on the plateau. They covered the track with earth and rocks for stretches as great as a half a mile in length. The large steel trestle bridge over the deep ravine on the edge of the city, the anchor bolts at the footing having been sheared, was shifted a maximum of 6 in., as described in *Engineering News-Record* of May 23, p. 999. Other than a slight twisting of the track and a bending of a few steel members, no damage resulted, and the bridge was promptly put into service again.

BRICK AQUEDUCT DESTROYED BY QUAKE, WITH TEMPORARY WOODEN FLUME CARRYING WATER

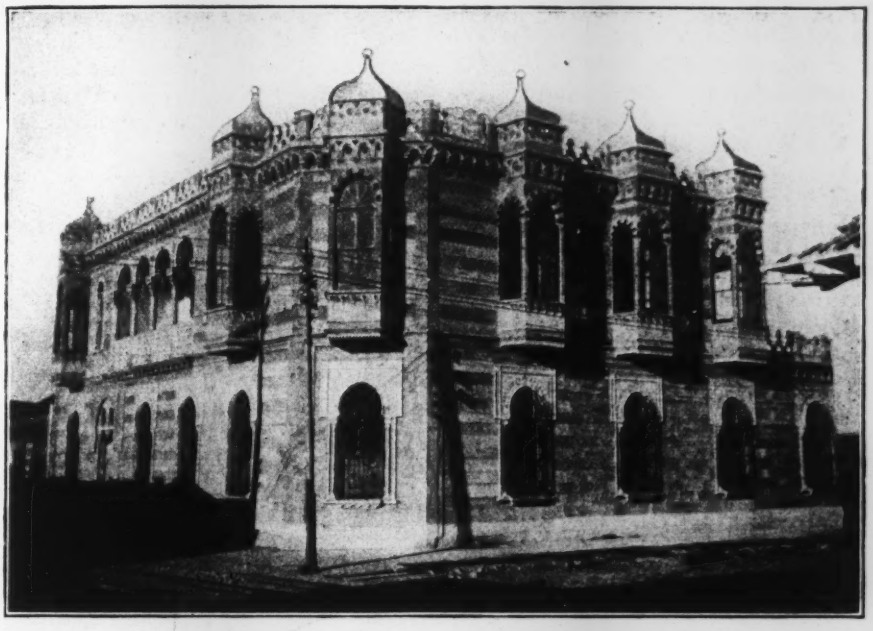
The primitive and inadequate sewers of the city are of rough masonry, very shallow and small, so that heavy

traffic on the streets often breaks through the pavement into the drains. Although twisted and broken to some extent by the earthquakes, the sewers continued to carry off what sewage still flowed from the city. They are liable to become badly clogged in the rainy season, when a large portion of the débris of the city will be washed into them. In the reconstruction of the city an entirely new sewer system is of great importance.

Because of the menace to the health of the people the Red Cross Commission gave considerable attention to the problem of the water-supply. Four systems supplied water to the city, two of them bringing the water

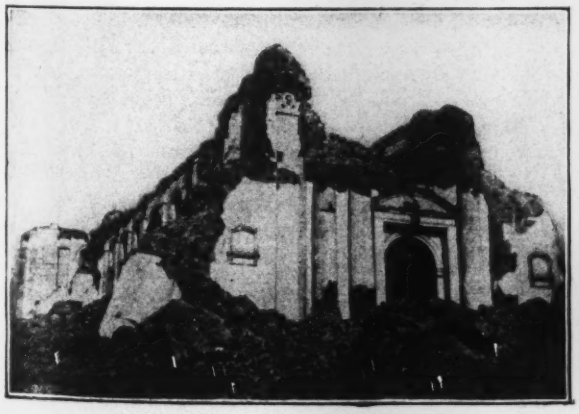
The Oldest Church in Guatemala, Built by the Spaniards Four Hundred Years Ago

The Cathedral, One Hundred Years Old



The One Reinforced-Concrete Building In Guatemala

Church of the Recollection, Whose Walls Were Twelve Feet Thick



Wooden Frame, Lath and Plaster Houses Which Withstood the Shocks

over large masonry aqueducts built 150 years ago, another conveying the water in a 14-in. cast-iron bell and spigot pipe, and the fourth in a 10-in. steel spiral riveted pipe. The masonry aqueducts were badly broken in many places, the 14-in. pipe was broken at many points both at the joints and in the sections between the joints, while the 10-in. spiral riveted pipe was opened in but a few places along the seams. The distribution systems through the city were disconnected, and the people consequently suffered a great want of water. The writer has even seen native women dipping out sewage to use for household purposes.

In brief, it was recommended by the Red Cross that about five miles of piping be immediately purchased in the United States and laid upon the surface of the principal streets, to supply 100 fountains to be located at the most important points. In order that it might be quickly and easily laid, and to resist vibrations of shocks best, flanged and bolted pipe was recommended. The Guatemalan Government accepted these recommendations for a temporary and emergency supply and purchased the pipe in New York. For its part, the Red Cross purchased and installed two chlorination plants on two of the reservoirs, in order to treat the grossly polluted water before its entry into the temporary system.

In the reconstruction of Guatemala City it will first be necessary to remove approximately 1,000,000 cu.yd. of débris. Structures proof against earthquakes will for the most part be erected, and concrete and wooden buildings have begun to make their appearance all over the city. The most popular form seems to be wooden framing with metal lath inside and out, covered with cement mortar, and corrugated iron sheets are taking the place of tile roofing. Although there is a great deal of lumber in the country large quantities are being imported from our Southern states and from the Pacific coast, on account of its better milling and seasoning. The lumbering possibilities in Guatemala are well worth the attention of American capital, as well as the great demand and need for American building materials.

[Supplementing his article in *Engineering News-Record* of May 23, p. 999, W. T. Penney, contractor, of Guatemala City, has sent the five photographs of buildings reproduced on p. 625. They show how well the one reinforced-concrete building (middle picture) withstood the shocks. Of its construction Mr. Penney, says:

"It should be taken into consideration, furthermore, that the concrete work and appliances on this one building were by no means up to date. The concrete was mixed by hand. The sand was volcanic and full of pumice, but was neither washed nor even screened. Most of the time the water was muddy. The rock was broken by a hand machine. Erection of the building was carried on in a desultory manner, the concrete work being delayed many times for a week at a time. In many cases the reinforcing was laid within half an inch of the surface. Also, the Moorish design of the structure called for many delicate members, as the photograph shows."—Editor.]

Seattle Plans Large Extension to Port Facilities

Main Improvement Is Terminal Pier 365 Feet Wide and Half Mile Long, With Complementary Cargo Sheds and Machinery

ADDITIONS to the pier and warehouse facilities of the port of Seattle, Wash., are planned for immediate construction that will fit the port for any increase in business incident to or following the war. The improvements are in the Smith's Cove terminal, which already has in Pier A one of the largest freight piers in the world. It is 310 ft. wide and one-half mile long, and has almost 4000 ft. of berthing space. It may be regarded as two long wharves, back to back, with four depressed railway tracks between.

About one-third of the area of the pier, or 130,000 sq.ft., is covered by one-story sheds, nearly 100 ft. wide, which have a cubical content of 3,500,000 cu.ft. The remainder of the structure, comprising 260,000 sq.ft., is an open wharf, the east side being used for export lumber and steel, while the west side is utilized for the storing and bulking of vegetable and fish oils. This pier will be widened and extended to West Garfield St. adding approximately 100,000 sq.ft. to the open wharf. The extension will permit of the straightening out of the railroad facilities at the pier, so that the capacity of the terminal will be materially increased. Slips on either side of the proposed extension to the pier will be dredged to the full depth of 35 ft. at low tide. The berthing space will be increased from 4000 lin.ft. to 6500, giving a total berthing space for 13 large ocean carriers. The cost of the extension of the pier will be approximately $400,000.

In addition there will be built a new pier B. This will be 365 ft. wide and 2700 ft. long, or a trifle more than one-half mile long. A slip 380 ft. wide separates the existing and the proposed terminal. A new slip will also be dredged to the west of pier B; in all, the dredging excavation will amount to more than 2,000,000 cu.yd., 1,000,000 of which will be used in filling two of the city waterfront streets. When finished they will give a direct paved thoroughfare from the business district to Smith's Cove, on an easy grade. Two 2-story cargo sheds, 120 ft. wide by 1000 ft. long, will be constructed at the street end of the new pier. Four depressed tracks will occupy the central section of this gigantic pier; the two outside tracks, on the open wharf, will be so situated that the locomotive cranes can operate over them. Two surface ship-side tracks will occupy the outer side of the structure. Crossovers will be provided every 500 ft., to increase speed and efficiency in switching. In all, there will be 4½ miles of railroad trackage on the new pier and a total of six miles of trackage, including the pier A extension and connecting tracks with the large Interbay Railroad Yard, which is directly behind the new terminals.

A great deal of heavy freight handling equipment is contemplated in connection with the new pier. Two 10-ton traveling cranes, each operating on 120 ft. steel spans 22 ft. above the open wharf, will travel 1600 ft. up and down the open area of the new structure, each crane serving one side of the pier. The elevated cranes are used so that valuable open wharf cargo space will

not be taken up by cranes. By the method to be adopted all the cranes will be operated above the cargo on the dock, and the traveling cranes will be able to unload direct from cars on the depressed tracks to ship and vice versa. This equipment will consist of high-speed cranes, with a view to handling heavy cargo faster than ever before. The cost of pier B will be about $2,000,000.

When pier B is completed and the extension made to existing pier A, a berthing space of 11,000 lin.ft. will be provided, permitting 25 large ocean-going vessels to load and discharge at the same time. Two 35-ton locomotive cranes will also add to the loading capacity, as will a battery of electric tractors and tractor trailers. Each train with a capacity of 8 to 10 tons will increase the means of handling in the cargo sheds. Eight portable second floor loading platforms will also be installed, to allow loading and unloading in connection with the second floor of the cargo sheds. A 100-ton shear legs will also occupy a prominent place on the pier, to expedite the handling of heavy equipment. This capacity to handle cargo on a tremendous scale is a special feature in the new design, and will help facilitate the movement of the large China and Japan trade and the trade with Russia that is expected to assume vast proportions after the war.

Precast Concrete Lumber Proves Successful in Mine

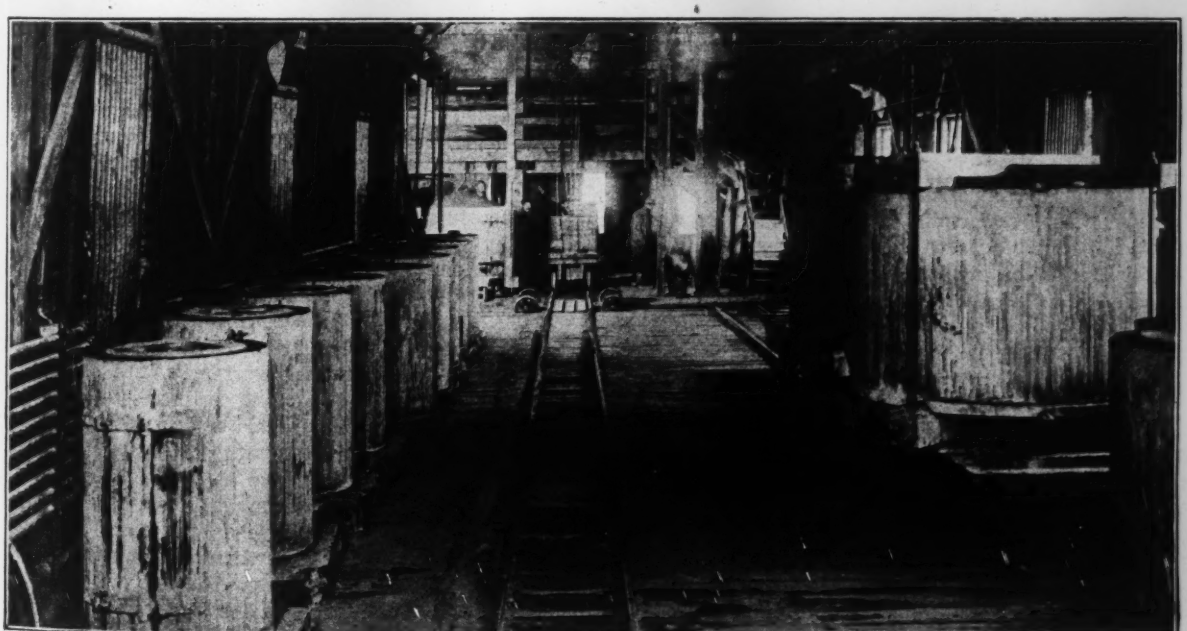
Fire Resistivity Sought in Replacing Steel-and-Wood or All-Timber Construction—Costs About Twice Those of Timber

DURING the past four years considerable precast concrete "lumber" has been used by the Oliver Iron Mining Co. in the relining of its shafts on the Vermilion and Mesaba range in northern Minnesota. A concrete plant was started in 1914 at Hibbing, and 450 complete shaft sets have been manufactured and shipped to all parts of the range. Much experience has been gained since the methods of making and using concrete lumber were described in *Engineering Record* of Oct. 31, 1914, p. 478.

Where a new shaft is to be lined with precast lumber it is excavated and constructed in much the same way as the ordinary timbered shaft. The surface of the ground is leveled and two trenches 4 to 6 ft. deep, depending upon frost depth, are dug for reinforced-concrete bearers 18 x 24 in., which support the shaft lining. These trenches are 20 ft. apart and 34 ft. long.

Cross-bearers of structural steel consisting of two 15-in. 33-lb. channels are placed under each wall plate. Under each divider the cross-bearer is one 15-in. 42-lb. I-beam. Channels are used under the wall plate so that hanging bolts may be placed in between. Immediately on top of the bearers is placed the first shaft set, consisting of two wall plates 20 ft. long, two 8-ft. end pieces, and two dividers 6 ft. 3 in. long. All of these are 12 in. square in cross-section, except that the dividers are 10 x 12 in. Forms are then built up for placing the concrete for the collar, which is from 6 ft. to 8 ft. in height, extends directly above the shaft set and prevents water and débris from falling into the shaft. Pockets are left in the collar for nuts for hanging bolts. As the earth is excavated it is placed around the collar.

The shaft sets are horizontal and are spaced 5 ft. apart. Each set is supported by twelve 1¼-in. hanging bolts, two in each end piece and four in each wall plate. Each set weighs approximately 10 tons, including the concrete lining slabs or lath. Posts or stuttles separating the sets are made up as follows: Four corner stuttles, 4 ft. long and 10 in. square, and four center stuttles under dividers, 4 ft. long and 8 x 10 in. Be-



LOOKING DOWN ONE BAY OF CONCRETE PRODUCTS PLANT WHERE CONCRETE LUMBER AND PIPE ARE CAST

tween sets there are eight 3 x 10-in. slabs and thirty-eight 3 x 10-in. slabs, all 4 ft. 2¾-in. long. These slabs are fitted in on the exterior side of the sets, being held in position by a 3 x 1¾-in. groove in the wall plates and end pieces and by the earth which is packed in behind the lath.

The 20-ft. wall plates are first lowered into position and the end pieces fitted over them. The stuttles are then put in place, after which the hanging bolts are placed in the proper holes. When the whole set is in position and lined up, the bolts are tightened and the lath shoved into position. Most of the shafts lined with precast lumber on the Mesaba Range are about 200 to 300 ft. deep.

The usual type of shaft used by this company has three compartments; a ladderway 6 x 6 ft. 4 in. and two skipways 5 x 6 ft. in the clear, with dividers in between, making the over-all dimensions 8 x 20 ft. At Spruce No. 4 there are five compartments. This shaft is now being sunk from a 240-ft. level to the 400-ft. level by the same method as described for other precast shafts. From the old 240-ft. level upward the shaft was relined in 1916 by the use of precast members. In this method jacks were used to hold up the concrete members until the end members and slabs were put in place along with the stuttles or posts. With the stuttles exactly 4 ft. long the end pieces and wall plates were fitted in at the corners so as to form a perfect joint. The dividers are notched at the ends into a dovetailed shape so as to fit into the wall plates. Ladders at the Spruce shaft are all of steel, as are the landing platforms. Between the compartments 6-in. wire mesh is used for protection.

First Cost Higher, But Sets Last Longer

Cost data tabulated during 1914 and 1917 show that concrete sets can be manufactured at a cost practically double that of timber. The cost of installation is a little higher, due to increased weight. The ordinary timber shaft must, however, be replaced within six or eight years, while a concrete shaft has an indefinite life, besides being fire-resistive.

All of the precast lumber on the Mesaba Range is manufactured at the plant at Hibbing, which has been in operation since 1914. Besides concrete lumber for mine shafts, concrete blocks and concrete pipe have been made in large quantities. The manufacture of reinforced-concrete sewer-pipe is somewhat new at this plant, but at the present there is being made 24-, 30-, 36-, 48- and 60-in. pipe in lengths of from 33 in. to 45 in. Under ordinary circumstances, eight men are employed at the plant, able to turn out daily 100 reinforced 3 x 12-in. concrete slabs 4 ft. 2¾ in. long.

Auto Oil Distributor Reported Economical

An auto oil distributor, to work in conjunction with three horse-drawn distributors, was placed in service in 1917 by the Department of Public Works, St. Paul, Minn., and is reported to have been more economical than the horse-drawn type. The auto oiler distributed 189,642 gal. of oil at a total cost of $1309.64, or $6.91 per 1000 gallons. The three horse-drawn oilers spread 252,105 gal. of oil at a total cost of $2138.56, or at the rate of $8.48 per 1000 gallons, showing a balance in favor of the auto distributor of $1.57 per 1000 gallons.

When Railroad Lands Are Used for Carrier Purposes

Interstate Commerce Commission Allows as Such, and Commends Purchase of, Lands Needed for Future Terminal Expansion

PROPER foresight demands that railroads acquire land for future development of terminals—so states the Interstate Commerce Commission in its final report on the valuation of the Texas Midland R.R. This, the commission states, does not imply unlimited license to buy land on the chance that it may sometime be needed. The test the commission applies as to whether the land is used for transportation purposes is whether the carrier can point out with reasonable clearness the probable future use to be made of it.

Other phases of the general problem of use or nonuse for carrier purposes are discussed in the report, the wording of which is in part as follows:

"The first step in the land appraisal is to determine what lands are used for transportation purposes and what are not, and this frequently involves questions of much difficulty. The act requires that lands, 'owned or used for the purpose of a common carrier,' shall be classified as carrier. . . . Can lands which have not been devoted to common-carrier use be classified as carrier land?

"One of the most serious difficulties with the present railroad situation is lack of proper terminal facilities. Railroad managers have not foreseen and properly provided for that great development of business which has not only rendered existing terminals inadequate, but which frequently renders it necessary to entirely discard such facilities and provide new ones in different locations. Owing to the great increase in the price of city lands it is usually extremely expensive to procure the land rights needed for this development.

Foresight Encouraged

"Any rule which would discourage railroads from exercising proper foresight in the purchase of land which will be needed for terminal facilities in the use and development of their properties would be most unfortunate, for it would not only tend to prevent the providing of the requisite facilities when necessary, but would much increase the expense of those terminals when provided. At the same time, to give to a carrier the unlimited right to purchase and hold at the expense of the public lands in the vicinity of growing towns, upon the belief that possibly at some time and in some way such lands will be needed for railroad purposes, opens the door to much extravagance and holds out an inducement to unfortunate investment. . . . While a liberal rule should be adopted, there must be some limit to the right of a carrier to hold or own land for transportation purposes at the expense of the public.

"The rule adopted has been that lands not devoted to the public service in fact may be classified as common-carrier, but this shall be done only in those instances where the public use is either actual or imminent. By 'imminent' is meant that the possible use must at least be capable of definition. It is not necessary that the lands be put to this use in any definite time after their purchase, but the carrier must be able to point out with

reasonable clearness the probable future use which is to be made of them. If the carrier asserts that the lands were purchased in good faith, believing that they would be required for carrier purposes, the presumption will be in favor of the carrier, but nevertheless the carrier must be prepared to state the reason upon which the belief is founded, and if the reason is found untenable the land is classified as noncarrier.

"It sometimes happen that the amount of land which is devoted by the carrier to a particular use appears to be excessive. For example, several acres may be used for station grounds when much less would suffice. The carrier's judgment is usually accepted.

"Carriers frequently permit the erection upon portions of the right-of-way of structures which are of a quasi-transportation character. Instances are milk sheds, grain elevators, coal chutes, etc. While these structures are owned by private parties, they perform a function of the carrier itself, in that they provide a means for the receiving, storing and handling of freight. A rental is sometimes paid for the use of this land, but this is seldom so, and often when money is paid the amount is nominal. In such cases the commission has classified the land as carrier. Where the dominant use of the structure is private, as in the case of a flour mill or a wholesale grocery store, the rule is otherwise.

"Carriers sometimes provide dwellings for employees. Where the situation is such that the employee in particular cannot be properly housed without the providing of living accomodations, these are treated as a part of the operative property and so classified, but where the employee could readily obtain accommodations without the assistance of the carrier, dwelling houses and structures of this sort are classified as noncarrier."

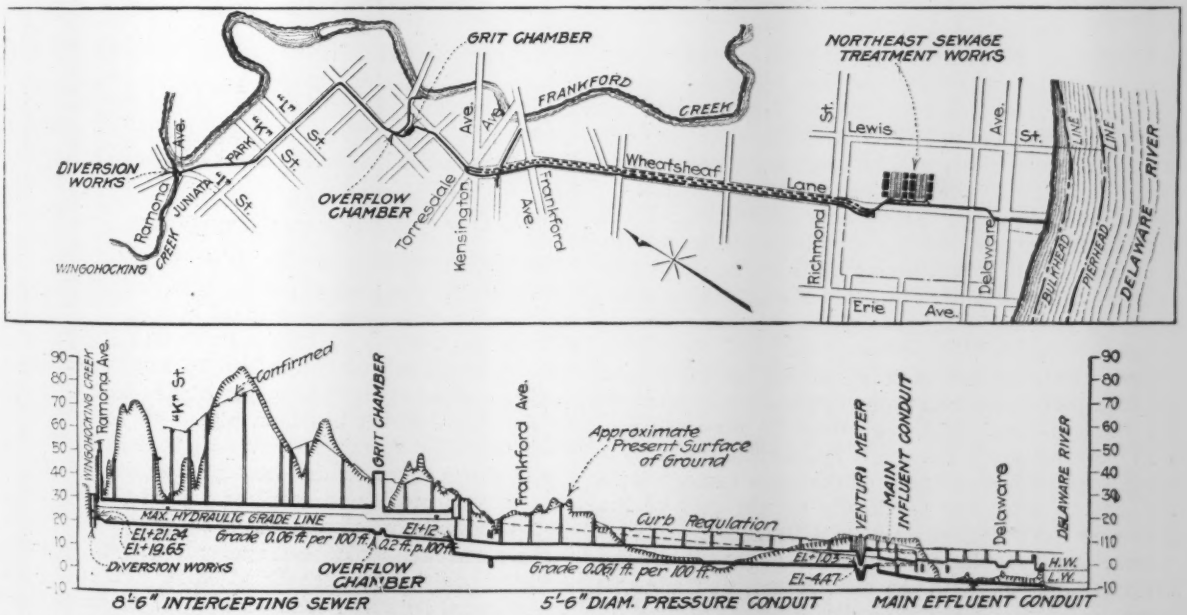
First Unit of Improved Means of Sewage Disposal for Philadelphia Well Started

Design Features Include Intercepting Sewer Partly Under Pressure, Ventilated Grit Chamber With Sand-Removing and Washing Plant, and Depressed Venturi Meter

By W. L. Stevenson
Assistant Engineer, Sewage Disposal Division, Philadelphia

PHILADELPHIA has made a good start on its comprehensive plan for the improved disposal of its sewage. Already construction is well advanced on the Frankford Creek high-level intercepting sewer and on the grit chamber of the Northeast sewage-treatment works, one of the three sewage-disposal units comprising the plan. The work now in hand was authorized by councils in 1915 and 1916, and $3,700,000 was appropriated to meet the construction cost of this unit and of the land for all three sewage-works.

Besides the interceptor and the grit chamber the work here described includes creek diversion works, a storm-overflow chamber and various accessories. The grit chamber will be equipped with sand-removing and washing apparatus. Portions of the intercepting sewer are under pressure. All the sewage passing to these works

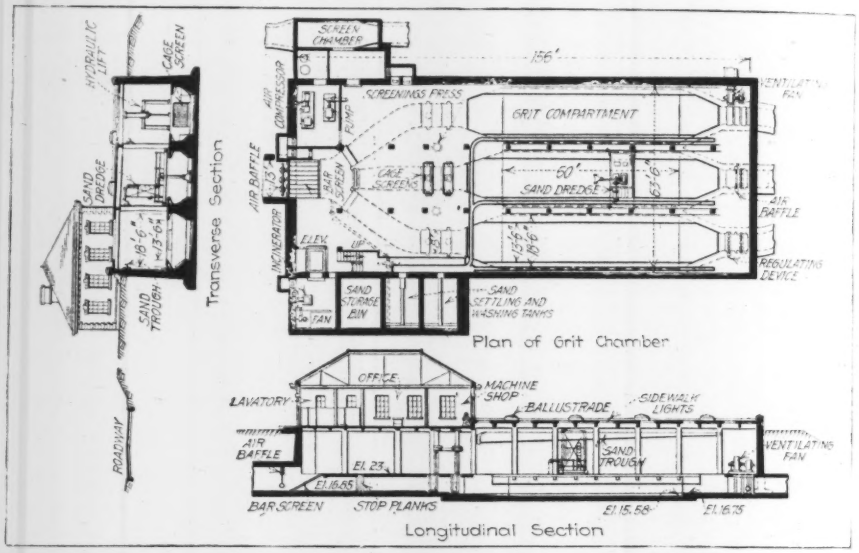


GRAVITY INTERCEPTOR DIVERTS SEWAGE FROM FRANKFORD CREEK TO TREATMENT WORKS ON DELAWARE

will be measured by venturi meters. The completed sewage-works will include Imhoff tanks.

This part of the entire project was carried out first because it will not only afford protection to the city's water supply but will also restore to a clean condition Frankford Creek, now grossly polluted by sewage, which flows through park property in its upper reaches and in a built-up part of the city at its lower end. Two-thirds of the city's water-supply is obtained from the tidal Delaware River at Torresdale. Frankford Creek empties into the river 4½ miles below the intake to the water filters. This creek is the natural drainage channel for the sewage of about 100,000 persons and for the industrial waste from the factories in Frankford.

The largest single source of pollution is the 19½-ft. combined sewer which serves Germantown and contiguous parts of the city. This sewer is laid approximately in the valley drained by Wingohocking Creek, and, as the sewer is not completed to its final outlet, the lower part of the creek is practically an open sewer. At Ramona Ave. and I St. Wingohocking Creek is joined by the smaller and comparatively unpolluted Tacony Creek, to form Frankford Creek. The bed of Wingohocking Creek and also the invert of the future sewer outlet at the same point are about 25 ft. above the water in the Delaware River. Hence it is possible to convey sewage from the drainage areas of these two creeks by gravity in an intercepting sewer to the treatment works on the bank of the Delaware River, two miles farther down stream from the water intake than the mouth of Frankford Creek. Sewage entering Frankford Creek at too low an elevation to be received by this high-level sewer will be intercepted by low-level sewers, and must be pumped to the treatment works.



VENTILATED THREE-COMPARTMENT GRIT CHAMBER IS EQUIPPED WITH SAND DREDGE AND TROUGHS LEADING TO SAND SETTLING AND WASHING TANKS

Across Wingohocking Creek, near its mouth, will be built a concrete dam, the top of which will be at such an elevation that it will divert all flows, up to double the average dry-weather flow, into a rectangular channel, in which a regulating gate will be built consisting of a rectangle constructed of structural steel and plates supported on a horizontal shaft in such an unbalanced condition that it will rest normally on stops in a nearly horizontal position. But when flows in the creek rise to an elevation above the shaft, hydrostatic pressure is exerted upon the upper part of the gate, causing it to close and to discharge practically all the flow of the creek over the dam into Frankford Creek.

From these regulating works the sewage from the Wingohocking sewer, in the near future, and later all sewage collected by the extension of the intercepting sewer along Tacony Creek, will be carried for 4475 ft. in an 8½ x 8½-ft. semi-elliptical concrete sewer having a vitrified brick invert laid on a gradient of 0.0006. It is designed to carry at two-thirds depth 160,000,000 gal. a day, which is 200% of the estimated dry-weather flow in the tributary combined sewers in 1950.

In determining the alignment of this portion of the intercepting sewer, two routes were possible; one approximately parallel to Frankford Creek where the sewer could have been built in a minimum depth trench; the other by the most direct streets but which necessitated a relatively deep trench and three tunnels respectively 500, 1278 and 707 ft. long. The latter route was chosen in order to decrease the distance the sewage must be carried and to deliver it as speedily as possible to the treatment works.

The sewer is not reinforced with steel, except that in the open-cut sections longitudinal temperature bars are used. Every effort has been made to obtain smooth interior surfaces on the concrete. The invert was built of smooth-faced brick with straight and sharp edges. It is anticipated that a coefficient of roughness as low as 0.013 will be obtained.

Overflow Chamber and Storm-Water Overflow

In the comprehensive plan it is intended that the intercepting sewers shall receive 141% of the average dry-weather flow of the combined sewers. But in the case of the upper part of the Frankford Creek intercepting sewer it was determined to receive 200%, as the land adjacent to Tacony Creek and the upper part of Frankford Creek has been placed on the city plan as a park. Not deeming it advisable to send these additional storm flows to the treatment works, it became necessary to provide an overflow weir at the lower end of the above-described part of the sewer.

This consists of a rectangular reinforced-concrete chamber which has a length of 62 ft. The roof span is supported by seven columns about 7 ft. apart along the line of the east side of the intercepting sewer. Between these columns a brick dam will be built to be

progressively raised as the depth of sewage increases in the future, so as to maintain its crest at the elevation of 141% of the daily average dry-weather flow.

The overflowed water will be conveyed by a rectangular 6 x 7½-ft. concrete conduit to a screen chamber where, if it is found necessary, a coarse, inclined bar screen can be placed.

It is about 600 ft. from this point to Frankford Creek, and there is a difference in elevation between the creek and the invert of the sewer of about 15 ft. This made possible the construction of a circular sewer only 6 ft. in diameter, laid on a grade of 2.335 ft. per 100 ft. to carry the maximum quantity of water at a very high velocity. In order to prevent discharge of the water in a manner to tear out the banks of the creek, the last 150 ft. of the sewer was made 8 ft. in diameter, built on a curve with a 70-ft. radius and with an invert grade of 0.4 ft. per 100 ft. This will reduce the velocity of maximum flows low enough to prevent erosion of the banks of the creek.

Screen and Grit Chamber

According to the comprehensive plan, the Frankford Creek high-level intercepting sewer and the Somerset high-level intercepting sewer join in the vicinity of Lycoming and O Sts., from which point their combined flows will be carried to the Northeast works. As the project involved about 7000 ft. of inverted siphon, it was deemed advisable to construct, at the point of the junction of the two intercepting sewers, the necessary works for screening and removal of grit from the sewage. For this purpose the city purchased an entire block of ground and the grit chamber is approximately in the middle of it.

Since the surrounding territory is expected to develop into a residential section, it was thought best to design the grit chamber so as to eliminate danger of nuisance and to permit the square of ground acquired for sewage disposal purposes to be made available as a park or playground. The entire structure will therefore be underground, covered by a roof and artificially ventilated, the only part showing above ground being an ornamental parapet wall and an office superstructure of pleasing architecture.

From the overflow chamber a short length of sewer will deliver the sewage to the west or inlet end of the grit chamber, where an inclined fixed bar screen, having 9-in. clear openings, will be placed in the channel in order to restrain from entry large objects which should not but may find access to the intercepting sewer.

Hydraulically-Operated Cage Screens

Immediately east of the screen the sewer will divide into three channels, each 8 ft. wide and provided at their entrances with stop planks, by means of which any one or more may be closed. In each of these channels there will be placed a pair of hydraulically-operated cage screens having two rows of ¾-in. round bars spaced 2½ in. c. to c. and staggered. The hydraulic cylinders will be controlled in such a manner that it will be impossible for both screens to be raised out of the sewage simultaneously.

Two presses will be provided, and the dewatered screenings will be disposed of in an incinerator, within the structure, which will also serve to supply the hot-water heating system for the building.

Immediately beyond the screens each channel is widened by diverging walls to a bottom width of 13½ ft. and a width at the top of 18½ ft. The sides of each grit chamber compartment are made sloping in order that the wetted cross-section of flow shall be such that, with varying depths, the velocity will be maintained at or near 1 ft. per second.

The full section of each grit chamber compartment is 60 ft. long; the inlet and the outlet sections are each 15 ft. long in order to obtain a gradual change in velocity and so utilize the entire 60 ft. of the grit chamber. In each outlet channel will be placed manually-operated regulating devices to increase or decrease the cross-sectional area and so assist in maintaining the proper depth of water in the grit chamber.

The roof of the grit chamber will be supported upon reinforced-concrete columns, carrying a series of girders and beams between which will be reinforced-concrete slabs. Over the grit chamber compartments proper every other slab will contain sidewalk lights with glass prisms. These will be placed in every slab in the west end of the roof over the screens, where most of the work will be done.

Sand Removal and Washing

It was not the intention to throw one of the grit chamber compartments out of service in order to remove the accumulated detritus, as this would have necessitated having four or even five separate compartments. It was necessary therefore to provide a method for the continuous removal of the sand as it accumulates, especially during storm flows. To accomplish this the division walls between the grit chamber compartments have at their tops cantilever walks carrying rails, upon which will travel a platform capable of being moved longitudinally over every part of each grit chamber compartment. Upon the platform a motor-driven centrifugal pump will be mounted, the suction of which is a flexible hose terminating at its lower end in a metal foot-piece. By means of a boom and suitable cables it will be possible to move the foot-piece transversely into any position and to hold it at any height above the invert of the grit chamber. The pump will discharge through a vertical riser into metal troughs carried on the sides of the columns supporting the roof and leading to the two sand-washing bins, each 15 ft. long, 11½ ft. wide and 13 ft. deep. The pumped sewage, carrying about 10% detritus, will enter the sand-washing bin through a port, and the sewage will be collected at the outlet end over a weir extending the width of the tank, from which it will be conveyed by piping under the floor to the inlet channel leading to the grit-chamber compartments.

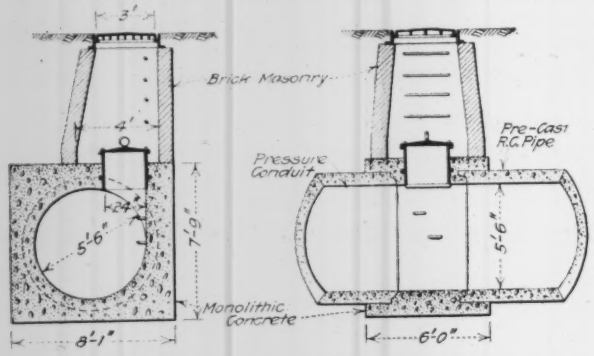
In the bottom of each of the sand-washing bins there will be placed the manifold piping and gravel commonly used in water purification, through which either air or water can be forced to wash the detritus free from organic material, the wash water being also collected from the weir and conveyed to the inlet channel to the grit chamber.

Over the sand washing bins will be placed an elec-

trically-operated traveling crane, the bucket of which can remove the clean sand and convey it to a loading platform, from which it can be hauled to the Northeast sewage-works by motor trucks for replenishing the surface of the sludge-drying beds. To protect the gravel from the dredging bucket, perforated cast-iron plates supported on concrete walls will be used to cover the gravel.

Beside the sand-washing bins, a sand-storage bin is provided which can be used in case of severe weather conditions or of a breakdown in the motor service requiring accumulation of sand at the grit chamber.

As the grit chamber is entirely underground and covered with what is practically a glass roof, adequate



MANHOLES UNDER PRESSURE HAVE INNER BOLTED-DOWN CAST-IRON COVERS

ventilation was provided. In the west and south side walls, at about ground surface, ventilating openings will be built which normally will be the only means for admission of fresh air to the grit chamber. In the northeast corner a ventilating fan will be placed of capacity sufficient to change the air in the grit chamber every 12 min. The discharged air will be conveyed by an air duct to the nearby storm-water overflow sewer.

To prevent air from the inlet and outlet sewers entering the grit chamber and destroying the ventilating system, air baffles will be hung in the inlet sewer and in each of the three outlet conduits. They will have spherical floats at the bottom, so that the lower edge of the baffle will just touch the surface of the sewage.

The minimum quantity of sewage expected to be handled in this grit chamber is 25,000,000 gal. a day, but its maximum daily capacity, with largest estimated flows in 1950, will be 170,000,000 gal. By means of the regulating devices in the outlet channels and the use of a proper number of grit-chamber compartments, it will be possible to maintain proper velocities for practically all rates of flow between the limits given.

Intercepting Sewer from the Grit Chamber

The sewage will be conveyed from the grit chamber for a distance of 1100 ft. in a sewer having an arch and an invert of the same shape as the sewer approaching the grit chamber, but it was designed with an invert grade of 0.2 ft. per 100 ft., while the grade of the arch is 0.02. This is accomplished by increasing the vertical side walls of the sewer from 3 ft. at the upper end to 5 ft. at the lower end. This was made necessary by the very great range in sewage flow.

The invert grade will produce self-cleansing velocities for the low flow, and the arch grade is parallel to the estimated maximum flows in 1950.

Between the lower end of this portion of the sewer and the Northeast sewage-treatment works the surface of the ground and the confirmed curb height of the streets is below the hydraulic grade line for discharge at El. +16 at the Northwest sewage-works, and it became necessary to design this portion of the intercepting sewer system as an inverted siphon. Careful study of the varying quantities to be carried indicated the most economical combination of conduits for this purpose to be respectively 5½, 6½ and 7½ ft. in diameter.

With the quantities of sewage anticipated in the near future it is only necessary, at present, to provide the first or 5½-ft. conduit, but as the headworks of the inverted siphon were located at a street intersection where a station on the Frankford Elevated Ry. is to be built, it appeared advisable to construct the headworks of all three pressure conduits across this intersection now as a monolithic reinforced-concrete structure.

The headworks proper consist of an underground chamber containing division walls. Each channel is provided with stop planks, by means of which the flow in the intercepting sewer may be diverted to any one or all of the three pressure conduits. Provisions are made in the headworks to place in the future large sluice gates in front of each tube, so that the flow can be entirely and securely shut off from any one of the tubes.

The sewage will be conveyed through the 5½-ft. and the two future larger pipes for a distance of about 6000 ft. under pressure. To obtain the maximum capacity for these pipes it was necessary to use a type of construction with the smoothest possible interior surface, and to reduce outward leakage to a minimum it was necessary to use a type of construction which would be impervious and provide against leakage through contraction joints.

Precast Reinforced Concrete Pipe

To meet these two conditions it was decided to construct these pressure conduits from precast reinforced-concrete pipes, provided with special grouted joints at their ends, containing copper expansion joints. The pipes were manufactured and stored on the site of the Northeast sewage-works prior to making the contracts for laying them, so that they would be well cured before being placed. The pipes were made of 1 : 1½ : 2½ concrete, reinforced with two layers of wire mesh. For tangents they were made in 8-ft. lengths and for curves in 4-ft. lengths, one end of which was beveled.

In laying the pipe, the concrete foundation was first placed; upon this the pipe was laid true to line and grade. Generally, a minimum cradle of concrete was carried up outside the pipe for a height of 21 in. above the outside bottom of the pipe. When passing under transverse streets subject to heavy traffic and having a small earth cover, or on curves, a maximum cradle was used, which extended up to the outside top of the pipe.

Pressure manholes are made by pouring a monolithic section of concrete between two pipes. In this monolith a flanged cast-iron circular piece is placed, having a bolted-down cover, over which the ordinary brick manhole is built.

This pressure conduit is being built in three contracts, one of which includes a passing under the four main tracks of the New York division of the Pennsylvania R.R. and the 28 adjoining railroad tracks. Another contract includes the grading of the street to provide a minimum cover of 4 ft. over the pipes, as the present road surface was for a considerable distance at about the same elevation as the bottoms of the pipes.

At the lower end of each of the three pressure tubes there will be placed a venturi meter to measure the flow of sewage. If it had been planned in the first use of the pressure conduits to operate them as inverted siphons, the venturi meter could have been placed directly in the line of the conduit, but, as it was deemed advisable to construct the first installation of tanks at the Northeast works at such an elevation as does not require the use of the inverted siphon principle, it became necessary to depress the venturi meter below the invert of the pressure conduit, so that even with very low flows in the bottom of the conduits the venturi meter would be entirely filled. To accomplish this, the lower end of the pressure conduit will be built as a vertical reverse curve made of precast pipe to the lower end of which will be attached the metal part of the venturi meter placed in an underground concrete chamber to contain the various accessories.

From the outlet end of the venturi meter the conduit rises until it reaches an elevation approximately level with the normal grade of the pressure conduit above the venturi meter. At this point there will be built at the present time the foundation for a terminal gatehouse containing the riser tubes which will be built when it is desired to utilize the pressure conduits as inverted siphons. From this point the sewage will flow through a relatively short rectangular concrete sewer to the main influent conduit of the Northeast works, which will consist of 32 rectangular horizontal-flow Imhoff tanks and 80 sludge-drying beds, having a capacity at three hours' retention in the tanks of 60,000,000 gal. a day. The effluent from the works will be conveyed by a rectangular reinforced-concrete conduit to submerged outlets in the bed of the Delaware River.

Supplementary Artesian Supply for Indianapolis

Each Well Equipped With Pump in a Reinforced-Concrete Pit — Special Foot Valve on Each Suction Pipe

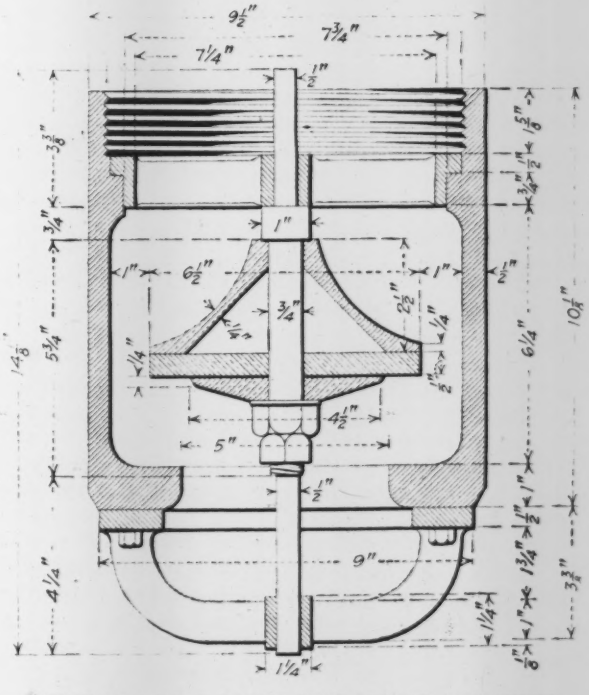
FEATURES of the supplementary artesian well supply being developed by the Indianapolis Water Co. are a special foot valve in each well and a reinforced-concrete pump pit. Fifteen wells will be sunk in addition to the 26 wells now in use at the Riverside station. The old wells are spaced about 360 ft. on centers and yield from 300 to 400 gal. per minute each. The new wells will be spaced 500 ft. apart, and it is expected that each will yield 400 gal. per minute.

The wells now being sunk vary in depth from 325 to 400 ft. They pass through glacial drift for the first 90 ft. and through water-bearing limestone for the remainder of their depth. All the wells are cased with 10-in. pipe to the limestone in order to shut off the water found in the glacial drift. The static head of the artesian supply is 12 ft. below the ground level.

Each well is equipped with its own pump. The 10-in. well casing is capped at the floor level of the pit with a special flange connection. Extending 35 ft. downward in the casing is a suction line of 8-in. wrought-iron screw pipe having a special foot valve at its lower end and reducing to 6 in. at its upper end. Between this upper end and the pump is a 5-in. gate valve.

The pump pits are of reinforced-concrete, with an inside diameter of 6 ft. and an approximate depth of 25 ft below the ground surface. The walls are 12 in. thick. The lower 12 ft. of the pit is subject to ground-water pressure, so a rich mixture of concrete was made for it and a 6-in. bottom provided, the whole monolithic. The 6-in. bottom rests on a slab of plain concrete. Collapsible steel forms were used both on the inside and outside of the walls. The pits are covered with a heavy galvanized-iron conical roof.

Electrically driven centrifugal pumps are used, operating against a total head of 60 ft., of which 25 ft. is suction head and 35 ft. discharge head. The pumps have a guaranteed efficiency of not less than 64%. The suction and discharge lines are each 4 in. in diameter, set vertical. This obviates the necessity of priming the



THERE IS A FOOT VALVE ON EACH WELL SUCTION

pump, as the artesian water level and the foot valve keep them primed at all times.

The improvement is being carried out by the working forces of the Indianapolis Water Co., under the direction of B. J. T. Jeup, chief engineer, and W. C. Mabee, assistant chief engineer.

Taking Soundings Above Niagara Falls from the Shore

Experimenting Develops Effective Use of Triangular Float and Weighted Pole, Controlled by Cables, for Work in Horseshoe Rapids

By Leon R. Brown
Office and Field Engineer, New York State Railways, Rochester, N. Y.

SOUNDINGS of the Niagara River just above the Horseshoe Falls were made by the writer entirely from the shore, the current being altogether too swift for boats, rafts or divers. The special float and weighted sounding pole devised, controlled by cables on windlasses, required a month of experimenting before they would work satisfactorily, but all the soundings were then taken in a few days. The operation took 12 men.

Over a large part of the area of the Niagara River, just above the Horseshoe Falls, between Goat Island and the Canadian shore, the river varies in depth from 10 to 20 ft. and has a velocity of about 30 ft. per second. The bottom is worn very uneven by the action of the water on the limestone and is strewn with many large boulders. The purpose of the soundings was not only to obtain the depth of the water, but also to obtain elevations of the bottom of the river so contours could be shown.

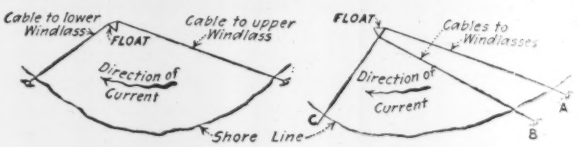
For a person to venture out with a boat or raft, even when secured to the shore with strong cables, was out of the question, for the craft would have been quickly overturned by striking a rock, or drawn entirely under by the swift current. It was impossible, because of the width of the river, to get soundings from a car carried on an overhead cable, and no diver, however heavily weighted, could keep his feet in the river. The conclusion was reached, after some experimenting, that in order not to risk human life some way must be devised to obtain these soundings from the shore.

The plan chosen was to operate a float or raft with cables from the shore. The float contained a sounding pole graduated in feet and weighted at one end, so arranged that it would always remain upright in the water. The pole moved up and down vertically and was operated by a trip rope from the shore. Its position was located by triangulation from the shore, and the elevation of the river bottom was obtained by level readings on the pole.

The float was constructed of three 12 x 12-in. pine timbers 16 ft. long, arranged in the form of a triangle, with the ends mitered and securely bolted. This was much more rigid than a square frame would have been, and did not require lateral bracing. The triangular shape also lent itself especially well to the action of the current and the scheme of navigation that was used to move the float from one point to another.

One of the most difficult problems was to get the float into a position to take soundings. At first, an attempt was made to attach two cables to the float, one secured to a windlass located a considerable distance above the area where the soundings were to be taken, and the other some distance below. These two cables were each attached to a corner of the float, the third corner being allowed to point toward the shore. Fig. 1 shows the plan. The current acting against the upper side of the float was expected to push it out into the river as far as was necessary to take the soundings.

By this arrangement advantage was taken of a great



UNSUCCESSFUL (FIG. 1) AND SUCCESSFUL (FIG. 2) METHODS OF CONTROLLING FLOAT

bend in the river. It was soon found, however, that the arrangement was not satisfactory. There was so much strain on the cable leading to the upper windlass that four men could not wind it up. At times the float with its long sounding pole was drawn entirely under the water, leaving no evidence on the surface to show where it was. The upper windlass itself was nearly drawn from its moorings and had to be secured by a long timber buried several feet in the earth. The lower cable continually caught under the large boulders in the bottom of the river as the float was moved in toward or out from the shore. But even had this arrangement been satisfactory, it was found that the float could not be forced out into the river far enough to cover the entire area where the soundings were wanted.

These difficulties were overcome by the arrangement

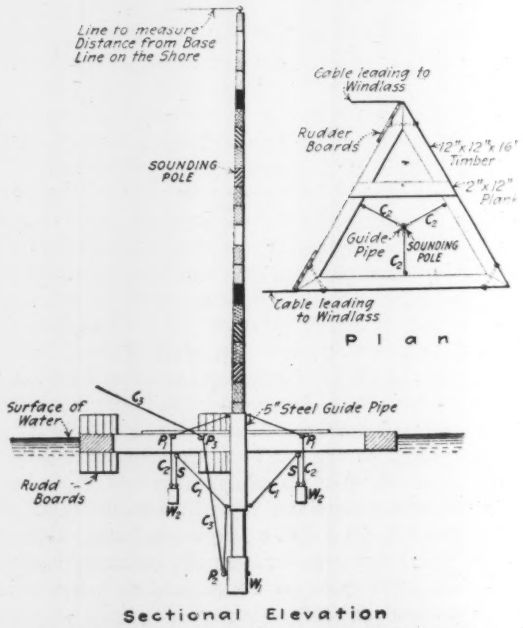


FIG. 3. PLAN AND SECTIONAL ELEVATION OF FLOAT

shown in Fig. 2. The downstream windlass was removed and placed by the side of the upstream windlass, the cables being attached as before to two corners of the float. This at once relieved the excessive strain on the cables. Instead of pulling against each other, they were now pulling together. Short planks nailed vertically on the upstream side of the float formed the rudder, and the control of the float was now almost perfect. The action of the current on the upper side of the float caused it to move away from or toward the shore, depending on the angle the side made with the direction of the current. This was controlled by the two windlasses. At the angle shown in Fig. 2 the float would tend to move out from the shore. The speed at which it would move at right angles to the current was astonishing. By changing the position of the windlasses it would have been possible to move the float entirely across the river. To move it up or down the stream it was only necessary to wind up or play out the cables from both windlasses at once.

A third cable leading to the shore at right angles at the point C was necessary to hold the float stable. At times the strain on this cable was so great that it required several men pulling on a block and tackle to haul the float toward the shore. This cable was found to be very convenient in the taking of a line of soundings at right angles to the shore. By merely paying off the cable, starting with the float near the shore and the rudder set for an offshore movement, one sounding after another could be taken without any movement of the windlasses. The course followed would actually be an arc of a circle, but the radius was so long that it approximated a straight line.

Almost Lost Windlass and Cable

To support the long cables leading from the windlasses to the float and keep them from catching under the large boulders in the bottom of the river, and also to keep the weight of the cables from dragging the float under, empty barrels carefully plugged and made waterproof were fastened to them about 200 ft. apart. These were attached to the cables by clips which passed through rings on special hoops around each end of the barrel. Special care had to be taken to keep the barrels from sliding down the cables. During the experimenting, when one of the windlasses was located near the brink of the falls, the downstream cables parted below the raft and several barrels and a long section of cable went over the falls. But for presence of mind and quick action shown in cutting the cable near the windlass, the windlass with all the cable attached would have been dragged over the falls by the floating barrels.

The sounding pole was 30 ft. long, about 5 in. in diameter, and octagonal in shape. The advantage of this shape was that the paint wore off only at the corners. It was found that a round pole sliding up and down in its pipe soon wore off all the graduations.

The bottom of the pole, for about 10 ft. where it received the most wear, was wrapped in sheet zinc, and around this at the extreme end was cast a lead weight of 200 lb. This was done by pouring melted lead into the space between the pole and a short piece of 8-in. cast-iron pipe, as shown in Fig. 3. An eyebolt that passed through both the pipe and the pole was cast in the lead and provided a place to attach the lift cable.

At first each alternate foot of the pole was painted black and white, but difficulty was experienced in reading it from the shore, as it was not possible to tell from the level instrument on which foot the reading was being made. Later, therefore, each foot was painted a different color, but, unlike the rainbow, the order of colors was arranged so that adjacent colors contrasted instead of blending. As not enough colors were found to paint each foot of the pole a different color, the colors were repeated in the same order. Thus if the levelman read on white he knew that it was either 12 ft. or 22 ft., and a glance at the pole would indicate which, because in the first case there would be 18 ft. of it above the instrument level and in the latter case only 8 ft. In a short time the levelman had associated each color with its number of feet, and so could read it instantly. Readings were estimated to tenths of a foot, and after each reading in the book the color was also marked for a check.

Holding the Pole Vertical

Great difficulty was found in holding the pole vertical at all times. If it were held rigidly at right angles to the plane of the raft it would seldom be in a vertical position, and the violent plunging and rocking of the raft would soon break it off. The problem was solved as shown in Fig. 3, by a system of $\frac{3}{4}$-in. wire-rope cables attached to a 5-in. steel guide pipe, through which the sounding pole slid up and down. Three cables or guys, C_1, each about 4 ft. long, went from an eyebolt in the middle of each side of the raft to another eyebolt riveted in the bottom of the vertical steel guide pipe, the cables being of such a length as to bring the top of this pipe about a foot above the top of the raft when the pipe was vertical. The guide pipe itself was 5 ft. long. These supporting guys held the entire weight of the guide pipe and the sounding pole with its 200-lb. weight. The guide pipe was held in a vertical position by three more guys, C_2, attached in a similar manner to the top of the pipe and then passing through pulleys P_1, attached to the middle of each side of the raft. On each of these three guys a weight of about 25 lb., W_2, was hung, the weight being about 3 ft. below the pulley when the guide pipe was vertical. The next step was to provide the supports, S, which were also of wire rope. These went from the weights, W_2, to the same ring in the middle of the side of the timbers where the main guys C_1 were attached, and were of such a length that all three were just barely taut when the plane of the raft was horizontal and the guide pipe was vertical.

With this system of guys and weights it will be seen that if the sounding pole is moved from a vertical position the weight or weights W_2 on the side toward which the pole is moved, stop pulling on the pole, for they are supported by the supporting cable S; on the other hand the weights W_2 on the opposite side are lifted and so tend to pull the pole back to vertical. It might have been possible to obtain this result with springs, but on short notice no satisfactory springs could be found.

The very heavy weight found necessary at the bottom of the sounding pole to cause it to go quickly to the bottom and help hold it upright was difficult to raise from the bottom, it being necessary to do this while

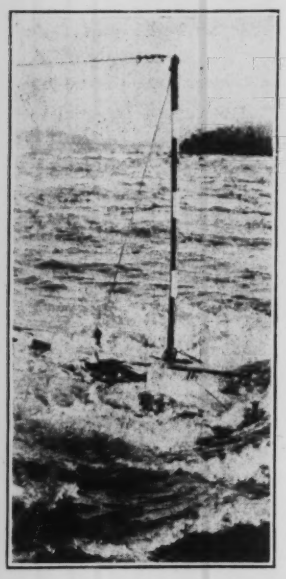
the float was being moved from one position to another. This was accomplished by securing one end of the trip cable, C_2, to the bottom of the steel guide pipe, then passing it through a pulley, P_2, attached to an eyebolt in the weight at the base of the sounding pole. The trip rope then passed through a second pulley, P_3, attached to a brace on top of the float, as shown, whence it went directly to the shore. This reduced by half the force that would have been required to lift the sounding pole if the trip rope had been secured directly to the weight, and also made the force lifting the weight more directly vertical, and at the same time put a strain on the guys, C_1, thus tending to hold the entire arrangement in a more stable condition.

Triangulation for locating the soundings with the aid of two transits on the shore was found unsatisfactory after trial, owing to difficulty in getting the readings simultaneously, and the necessity of plotting up the locations each time to be sure the soundings were being taken at the proper points. This method was abandoned for the range system. A base line was established near the shore with white stakes driven every 20 ft., and directly back of these another row of stakes was set, each stake being directly opposite the corresponding one in the base line. The sounding pole on the raft could then be brought into line with two of these white stakes.

The distance of the raft from the base line was measured by a line running from the top of the sounding pole to the shore. White tags were tied on the line at each 20-ft. point, starting on the pole as zero, and the tags were marked 20 ft., 40 ft., etc. When the line was taut the number of the white tag over the base line indicated the distance of the sounding pole from the shore.

When soundings were being taken four men operated the windlasses, two the trip rope, four the tackle attached to the cable leading at right angles from the shore to the raft, one man read the level and a signalman directed the work. The signalman gave instructions to the men at the windlass by the aid of a red and a white flag—the red flag for one windlass, the white one for the other. A flag held high in the air meant wind; horizontal, pay out. It was not necessary to use the signals a great deal, for when a regular order for taking soundings was established and all understood which sounding was to be taken next, each person knew just what he must do to get the float in the proper position to take that sounding.

In order to get the level closer to the water and thus eliminate the need for a longer sounding pole, a special tripod was devised which brought the telescope about a foot above the surface on which it was standing. The level was then placed on a stone pier which projected above the water, and a special scaffold was made to hold the levelman.



LEFT—NEAR VIEW OF FLOAT AND SOUNDING POLE

CENTER—NOT FAR FROM BRINK OF FALLS—LEVELMAN WORKING ON SPECIAL SCAFFOLD

RIGHT—FLOAT DRAWN NEARLY UNDER BY SWIFT CURRENT—RIVER 20 FEET DEEP

The operation of the sounding apparatus was now found to be nearly perfect. The first soundings were taken upstream, and as near to the windlasses as was possible.

Starting at the shore a row of soundings was taken out at right angles to the shore. The raft was then let downstream 20 ft. and another row taken back toward the shore. When it was in the best working order a sounding could be taken and the raft moved to another position in about a minute. It required, as previously stated, a month of experimenting to get the float in good working order, but when the float was completed all the soundings were taken in a few days. To take a sounding the signalman would get the raft into position to take the soundings by flag signals to the men at the windlasses and those at the snubbing cable that regulated the distance of the raft from the shore. When the raft was in proper position he would call "Trip," the men on the trip rope would let go and the sounding pole would drop vertically to the bottom of the river. The levelman would take his reading, and when he signaled all right the sounding pole would be pulled up and the raft moved into position for the next sounding. The range numbers and the distance of the soundings

from the base line were given by the signalman to the levelman and recorded with the level readings.

The writer believes that however swift the current or uneven the bottom, however wide the river or turbulent the water, or however dangerous the location, accurate soundings may be taken in water up to 20 or 30 ft. deep cheaply, quickly and safely with an apparatus of this general description.

SOCIETY SERVICE

A Section Dealing with the Results of Teamwork by Technical Men

Remission of Initiation Fee as Special Inducement

Initiation fees required of those joining the Engineers' Society of Western Pennsylvania are being remitted during the war, as a special inducement to get engineers into the organization. The membership committee feels that the most important thing is financing the going organization, which must be done almost entirely by the dues; the initiation fees go into a permanent fund. The activities of the society and its attractiveness to its members depend largely upon keeping up the membership. In addition, members of the four national societies are admitted, without further formality, to the similar grades in the local society.

Southwest Engineer Outlines Proper Society Activities

Three fundamental causes were given as reasons why engineers as a body are not usually invited to discuss public matters, by E. E. Sands, city engineer of Houston, Tex., in addressing the newly established Houston Engineers' Club. They are as follows: Improper education; lack of recognized standards, and devotion to strictly technical matters rather than Governmental activities or economics. Technical schools have been weak, Mr. Sands said, in that they have devoted a large amount of time to such matters as foreign languages and other subjects that are of no practical benefit to the practicing engineer, and have neglected to give the engineer proper training in such matters as practical English, corporation finance, civil government, banking practice, auditing, cost keeping, commercial law, management, and many other branches that are considered essentials by the man who conducts either a public or a private business on a large scale. The lack of a professional standard is recognized by all of us, in Mr. Sands' opinion. He said that any man can establish an office and advertise himself as an architect or an engineer, and if he can get clients who are willing to pay him for his services there is no way (regardless of his qualifications) to prevent him from making an attempt to practice the profession. Before a man can practice medicine, he must pass certain examinations; before he can practice law, he must be admitted to the bar, where his qualifications are judged solely by those already in the legal profession; but the legislatures of most of our states have either neglected or absolutely refused to pass laws that would put engineering and architecture on proper professional planes.

The members of the engineering profession, due to the peculiar training they have received and the character of the work which they follow, are likely to be clannish, and are inclined to prefer association with other engineers and the discussion of technical subjects to taking active interest in public and social affairs—such interest as is necessary to enable a man to view public problems in their broader aspect.

Some of the problems which Mr. Sands felt the club could take up with profit are public sanitation, regulation of street traffic, the motor truck problem, the matter of securing highway and paving funds, the state highway law and its administration, the state conservation law, the state sanitation law, known as the "Anti-stream pollution act," garbage removal and disposal, state and city building codes, plumbing codes, electrical codes, the building and maintenance of city streets, county road and drainage projects, street widening projects, fire protection, grade crossings, traffic laws, street lighting, the rates and franchises of public utility corporations and the platting and subdividing of land in and around cities.

"The whole career of an engineer," said Mr. Sands, "consists of investigating conditions, applying the principles of mechanics in designing structures to meet the conditions found, revising plans to secure the approval of those who have had large experience and are possessed of sound judgment, and last, but not least, to organize crews of workmen to carry out the plans with honesty, efficiency and economy. What better training is there to fit a man for public life? As members of the profession you not only owe it to yourselves but to the public to give its affairs careful consideration and, after mature thought, to let your voice be heard."

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Is Surface-Area Grading of Concrete Misleading?

Sir—The paper on "Proportioning Concrete by Surface Areas of Aggregates," which Capt. L. N. Edwards read at the June meeting of the American Society for Testing Materials and of which you present an abstract in *Engineering News-Record* of Aug. 15, suggests conclusions which would seem to need further comment. Captain Edwards has made a thorough study of one phase of the subject of aggregating, that of coating all aggregates with cement. But it is only one phase, and the conclusions must be more or less misleading and cannot by themselves lead to the solution of a very important problem.

The principle which his investigations attempted to prove is that strength of concrete depends directly on the ratio between the quantity of cement and the total area of aggregate—on how well each grain of aggregate is coated with the gluing material, the cement.

Captain Edwards adduces a series of tests showing that where this ratio is constant the strength, both tensile and compressive, is also constant.

If this principle is correct and if there were no other variables that entered into the series of tests, it must also hold if carried to still greater extremes. For instance, from Captain Edwards' table it appears that of sand passing a 4-mesh screen and held on an 8-mesh, there are 14 grains in a gram; from a diagram it appears that such sand has about 1 sq.in. of surface area per gram. To coat these areas as thoroughly as were the tested samples would require only one gram of cement to 13 grams of such sand; it should show the same strength in a 1:13 mixture as those that were actually tested.

If proportioning concrete were entirely a question of coating surfaces this 1:13 mortar should test as strong as the rest. One could go further and simply coat coarse aggregates with cement in absurdly lean mixtures and expect the same strength. The real problem in aggregating at once presents itself—that of filling voids. They must be filled. Every desirable property of concrete—strength, toughness, impermeability, resistance to wear—all demand density. Captain Edwards' series of tests did not go beyond proportions where sufficient cement is supplied to fill voids, and within those limits his conclusions are probably correct, but they do not in any manner point the way to the best concrete. They do not tell us what to fill voids with.

The problem has two aspects: Not only must all surfaces be coated with cement, but voids must be filled. It is to reduce surface areas that we use coarse aggregates—the largest that the character of the work permits and as many of them as possible. But even-sized coarse aggregates have 40 to 50% of voids, and these must be filled. Again, to keep down the proportion of areas to be coated they should be filled with the largest grains possible without spreading the larger aggregates, and so on down to the microscopic cement. In short, a mixture of sizes alone will fill voids.

Captain Edwards' conclusions are misleading in so far as they tend to create the impression that a proportion of 50- and 100-mesh material in sand is not beneficial. The grading should continue down to the cement, which is virtually all less than 1/200 in. in diameter, because 40-mesh sand has still voids that are large as compared with the cement particles. These voids may have diameters 10 times greater than that of the cement grains, which means that they have 100 times the area and 1000 times the volume, so that it may require 1000 grains of cement, even after surfaces are coated to fill the voids—which it is so essential to do. Even these voids had best be filled not with neat cement but, to reduce the areas to be coated, with the largest grain of sand that can be used, 80—100-mesh or even 200-mesh aggregates. In short, grading must continue below 40- and 50-mesh to gain the best results.

All research on this subject bears out this assertion. Innumerable tests, in which the fine aggregates were divided into three grades and all possible combinations of these grades were tested, show that the greatest tensile strength is attained when 20% of the fine aggregates are such as pass a 50-mesh screen. The accepted grades are ¼ in.- to 20-mesh, called "coarse," 20- to 50-mesh, called "medium," and the "fine," passing the 50-mesh screen. The results plotted on the Feret triangle show that 70% of coarse, 10% of medium and 20% of fine sand produces maximum tensile strength in mortar mixtures.

Another consideration enters. Most of the tests reported were made with mortar only, not with finished concrete. In mortar, then, we find 70% of the largest permissible grains (those ranging from ¼-in.- to 20-mesh) beneficial with only 10% of medium and 20% of fine. In actual concrete in which coarse aggregates are added to the mixture, we would also find that about 70% of the largest permissible size (now the coarse aggregates) would produce optimum concrete. Fine aggregates—the remaining 30%—would then take a place corresponding to the two grades of "medium" and "fine" in the mortar tests. The proportion of coarse sand necessary to gain maximum results would be greatly reduced, and the proportion of fine grains would be correspondingly increased.

It would seem, therefore, that the final report, July, 1916, of the Joint Committee on Concrete and Reinforced Concrete is not in error in recommending as it does the use of sand or screenings of crushed stone graded from fine to coarse of which not more than 30% by weight should pass a sieve having 50 meshes per linear inch.

In spite of the fact that it takes 10 times as much cement to coat 100-mesh sand as 10-mesh, and that concrete made entirely of dust is impossible because there are too many joints to glue, still nothing should be done to create the impression that a percentage of fine dust is detrimental to the concrete. It is beneficial; theory and practice both confirm this, and the recommendation of the Joint Committee, to limit 50-mesh and finer grains to 30% by weight of the fine aggregates, is conservative.

R. W. SCHERER,
Secretary, Wisconsin Crushed Stone Association.
Milwaukee, Wis.

The above letter was submitted to Captain Edwards, who replied as follows:

Sir—The component materials of an ordinary mortar mix are cement, water and sand aggregate. A concrete mix is produced by the addition of stone aggregate to the mortar mix. The cement and a portion of the water combine chemically to form the cement matrix, which ultimately binds together the inert aggregate particles.

"While the character of the aggregates and the amount of water used influence results to a marked degree, the proper proportioning of the cement is a matter of the utmost consequence, since this is the only active, strength-producing material entering into the mixture." Speaking broadly, the above quotation from the paper in question appears to cover the general situation. That the proper proportioning of the materials of a mortar or of a concrete mix is an intricate problem, containing many variable factors, some of them unknown, is generally conceded, and appears to be in accord with Mr. Scherer's views.

In the fourth paragraph of Mr. Scherer's letter the statement is made, "The real problem in aggregating at once presents itself—that of filling voids. They must be filled. Every desirable property of concrete—strength,

toughness, impermeability, resistance to wear—all demand density." This statement (slightly modified in the following paragraph) indicates clearly that its writer accepts the fundamental principle of the century-old void method of proportioning concrete materials. The formula for this method when reduced to its simplest form is: "Find by actual test how much cement it takes to fill the space in the sand, also how much mortar

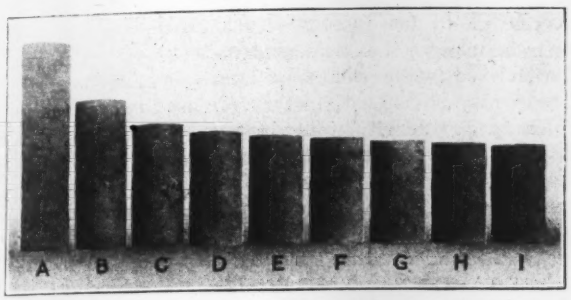


FIG. 1. MORTAR CYLINDERS IN WHICH CEMENT CONTENT WAS DECREASED

Grams cement to sq.in. sand area:

(a) 1:5	(d) 1:20	(g) 1:35
(b) 1:10	(e) 1:25	(h) 1:40
(c) 1:15	(f) 1:30	(i) original sand

it takes to fill the space in the stone, and proportion the materials accordingly."

The many factors tending to render difficult the absolute determination of the voids in the materials are too well known to be discussed further here. Passing now to the practical value of a knowledge of the percentage of void existing in a given sand, the author's test, "Bulking Effect of Cement Content of Mortars," clearly shows that the original volume of the sand is appreciably increased by the addition of a comparatively small quantity of cement. Figs. 14 and 15 of the original paper are here reproduced as Figs. 1 and 2, and the following is quoted therefrom:

"In this connection it is of interest to note that the void in sand "F" was found to be 31.3 per cent. By the void method of proportioning the quantity of cement paste necessary to fill the void in 1200 g. of sand bulking 41.29 cu.in. would be 12.92 cu.in., requiring 374.3 g. of dry cement. With no allowance for the separating of the sand particles, this corresponds approximately to a cement content, 1 g. cement to 22 sq.in. sand area, by the surface area method."

Figs. 1 and 2 provide no evidence tending to show the practical value of a knowledge of the percentage of voids, since they indicate no marked change in the increment of increase of volume due to the cement content exceeding the voids.

Mr. Scherer asserts that the "series of tests did not go beyond proportions where sufficient cement is supplied to fill voids." In this connection attention is directed to test series No. 2 of the tests wherein two tests contained less than this amount of cement. However, the test results (Fig. 3, *Engineering News-Record* of Aug. 15, p. 318) give no special evidence of this condition.

Why must we fill the voids? Nature, the great mortar and concrete maker of a pre-man period, appears to have totally disregarded this refinement in the construction of the hardest, toughest, strongest and most reliable sandstones (mortars) and conglomerates (concretes). A microscopic examination of the most reliable of these materials will show this statement to be true. Such an examination will also show that nature apparently gave no special care to the obtaining of a "maximum density" grading of the aggregates. However, be that as it will, the examination will further show ample evidence of carelessness in the final placing of the particles, for the largest particles are very frequently found to be wedged and held apart by the smaller ones. Fig. 3 shows (a) a photomicrograph of Caledon (brown) sandstone, and (b) a photomicrograph of the fractured surface of a very weak but thoroughly compacted cement mortar. Note the similarity in the hit-or-miss arrangement of the small particles. A perfect distribution of the sand particles such as Mr. Scherer suggests is quite contrary to nature's "habitual distribution," and, to say the least, is unattainable by any mortar- or cement-making methods now in use.

The microscopic examination of nature's sand mortars shows another, and we believe, a more interesting and possibly a more important detail in their construction, viz: Nature, by depositing the greater portion of its cementing material at the points of contact of the sand particles, has obtained maximum strength by the use of minimum quantity of cementing material. Here we have the most important difference between natural and artificial mortars. The former are "percolator produced," the latter "mixer produced."

From the above considerations we conclude that, in so far as the physical properties of sandstones are concerned, these properties are considerably less dependent upon the void contained than upon the hardness, strength and other physical properties of the inert ma-

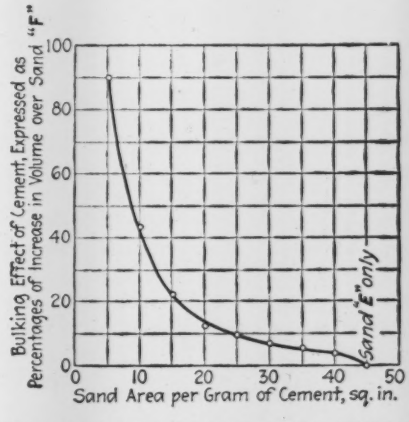


FIG. 2. RELATION OF CEMENT CONTENT TO BULK OF MORTARS

terials and the strength and volume of the cementing medium holding their component particles together.

The real object and purpose of the stone aggregate in concrete is, the writer believes, somewhat at variance with that stated by Mr. Scherer. Apart from its effect upon the strength of the final mass in comparison with that of the mortar alone, its inclusion in the mix distends and "bulks up" the mortar to an extent equal to the net volume of the stone content of the mix. Disregarding the effects of excess water, poor workmanship, time of mixing and various other conditions affecting the strength of cement, its strength is depend-

ent upon the physical properties of the stone and upon its volumetric relations to the mortar content of the mix. If the strength of the stone be equal to or greater than the strength of the mortar portion of the concrete, then the reduction in strength as compared with the mortar is approximately as shown in Fig. 4, the data for which were obtained from a series of tests made by the writer. Economy of materials, cement in particular, consistent

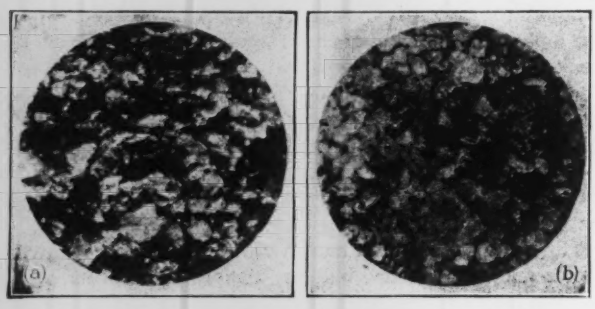


FIG. 3. DISTRIBUTION OF SAND PARTICLES IN SANDSTONES AND IN MORTARS
(a) Caledon Brown Sandstone. (b) Cement Mortar.

with the obtaining of a desired strength is, therefore, the primary purpose and object of the use of the stone aggregate in concrete.

It is not clear how Mr. Scherer gained the impression expressed in the first sentence of the sixth paragraph of his letter. All sands used in the tests contained material passing the Nos. 40, 50 and 80 sieves and retained upon the No. 100 sieve. The tests clearly show that by the surface-area method of proportioning, sands passing a No. 40 and retained upon a No. 100 sieve are adapted to the production of mortars possessing strengths equal to mortars of the same cement-area ratio produced from sands passing a No. 4 and retained upon a No. 100 sieve. The point raised in the latter portion of the paragraph is fully dealt with in the discussion of "Practical Limitations" of the method.

In the seventh paragraph of his letter Mr. Scherer apparently has in mind a sand graded to "Fuller's Curve of Maximum Density." Such a sand, if used in a 1:2:4 (volume method) concrete would produce a harsh "unworkable" mix, having little cohesion between its component materials. The proper placing of such concrete within the forms would involve an excessive amount of labor, difficulty and expense. Sands approximating this grading are rarely found in natural deposits. They are entirely inadaptable for the production of practical mortars and concretes. As compared with such a sand the author contemplates only the use of well graded coarse sands adapted to the production of a "workable" mortar or concrete mix.

In the eighth paragraph Mr. Scherer gives his specification for inert aggregate to be used in concrete. The percentage of stone particles (over ¼ in. diam.) is about 5% greater than is commonly used in concrete making. Doubtless the concrete mix produced by the use of such aggregate would prove "stony" and somewhat "unworkable." The concrete when thoroughly hardened would be short and friable rather than tough and durable.

The nominal sizes of sieves Nos. 4, 10 and 100 are 0.025, 0.075 and 0.0055, respectively. The surface areas of sand particles passing these sieves bear a somewhat different relation to each other from that stated by Mr. Scherer in the last two paragraphs of his letter.

The recommendation of the Joint Committee contemplates the use of sands passing a No. 4 sieve, and limits the portion passing a No. 50 sieve to 30%. Natural sands fulfilling the committee's requirements will rarely contain a percentage of sandy "dust," passing a No. 100 sieve, exceeding 3% to 5%. Such a sand, well graded from coarse to fine, is adapted to the requirements of a general concrete, the component materials of which are proportioned by the commonly used volume method. It may or may not be satisfactory for use in concretes in which special density, toughness, impermeability, etc., are important factors. The "surface-area" method is adapted to the use of a wider range of sand gradings than is contemplated in the committee recommendation.

Mr Scherer's claim, "It is beneficial; theory and practice both confirm this," having reference to the in-

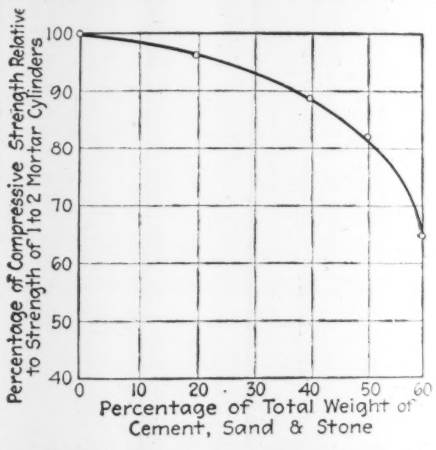


FIG. 4. RELATION BETWEEN STRENGTHS OF CONCRETE OF DIFFERENT STONE AGGREGATE CONTENT

clusion of "dust" in sand aggregate, is, to say the least, far reaching. The writer has failed to find a published record of a complete and systematic investigation of the effects of "dust" in sand aggregates, proving such a claim. Theory, as contained in our best books on concrete design and construction, makes no claim tending to show that it is beneficial. Practice, as recorded in a well known standard specification (American Railway Engineering Association), limits its existence to 6%, not because of its beneficial effect, but for purely practical reasons.

LLEWELLYN N. EDWARDS,
Supervising Engineer of Bridges.
Toronto, Ontario.

Track Elevation at Chicago Is Checked

By agreement between the city, the railways and the Director General of Railroads the progress of track elevation in Chicago will be limited mainly to the completion of two pieces of work whose present condition causes interference with street traffic. These are on the Baltimore & Ohio R.R. between 64th and 69th Sts., and the Rock Island Lines between Vincennes Road and 87th St. The costs are estimated at $200,000 and $185,000, respectively. Work estimated to cost more than $6,000,000 has been deferred until after the war.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Ladies Enter the Lists Against Labor Turnover

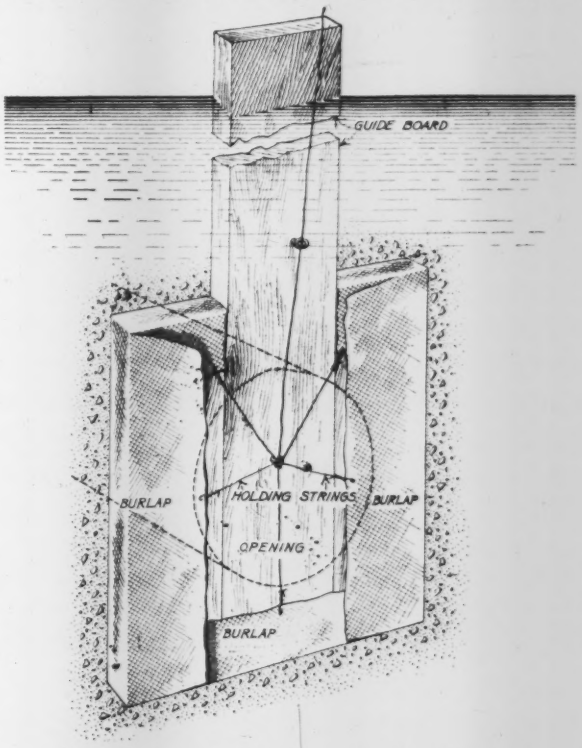
LABOR turnover, that ancient foe of the contractor, is destined, if the editor possesses prophetic vision, to receive a stunning wallop from the wives of the workmen on a large construction job recently visited. Some hundreds of workmen are employed and most of them live in construction camps. The bunk houses at these camps are distinctly model buildings of their sort, but they are not the camp structures which first challenge attention. The latter are the scores of family cottages for managers and machine operators and skilled artisans. Painted outside, decorated inside, architecturally attractive, having running water, electric lights, kitchen ranges, water heaters, bath rooms and sewer connection, these cottages have little resemblance to the ordinary packing-box type of camp houses for married workmen. So pretty were some of these homes which had been occupied longest that they invited an intrusion which the house mistresses met with courtesy. Now, the abounding pride with which these ladies pointed out the curtained windows, called attention to built-in cupboards and cases of drawers, and opened clothes closets and little attic store rooms, bred a thought. That thought was that none of these wives would be likely to greet with encouragement a proposal to tear up, pack up and move away, unless "friend husband" produced a mighty strong argument for the change.

The creation of such a mental attitude in the worker has more than sentimental merit. It has a direct monetary value in decreasing labor turnover. At first sight, perhaps, it seems a long road from lace curtains to labor turnover, but when one comes to pace the distance he discovers that the two are only across the way from each other. A contented wife is a great factor in making a contented workman, and a contented workman does not lightly change his job, and lace curtains and the things they signify have much to do with making contented wives. On visiting these camp cottages the editor wondered how a man had managed to think of and take trouble over all the little housekeeping conveniences and embellishments. The answer is that he didn't. That is, he didn't think of them all by himself. He, too, had a wife and when he had roughed out his camp-house plans she said, "Now that you have made them strong and warm and sanitary, I will make them livable," and she put shelves here and a closet there and a cupboard in another place wherever there was space, and saw that there was a window over the kitchen sink and a place for an ice box, and looked out for all the really important things, including rods for lace curtains and trellises on the porch columns for morning glories, which a woman finds necessary to make a home out of a house. So all this is why this talk started out with the statement that our enemy, labor turnover, seems likely to make way for the ladies after successfully blocking the efforts of menfolk since Solomon built his temple.

C. S. H.

Closing the End of an Inlet Pipe

IT BECAME necessary to make a connection to the 24-in. supply pipe from a reservoir at a point where the pipe was about 12 ft. below the level of the water in the reservoir, writes James M. Purcell, Richmond, Va., in a recent issue of *Power*. The pipe had no shutoff valve and attempts were made to close its inlet end with bags of sand without avail. A wooden "gate" was then tried but considerable water leaked in between



BOARD PLACED OVER THE END OF INLET PIPE

Other Articles of Interest to Contractors In This Issue:

Altering Old Office Building Requires Heavy Underpinning — Page 610
Lay Down Lines of Organization for Contractors' Association — Page 619
French Concrete Tugs Launched by Swinging from Cranes — Page 621
Guatemala Earthquakes Destroyed All Masonry Buildings — Page 623

the wood and the irregular surface of the end of the pipe. Finally the job was made a success by placing a heavy canvas bag over the "gate" held snug by a string, as shown, before pushing it down in front of the pipe. When in position the string was broken and the bag released. The water pressure then forced the canvas into the leak holes and stopped them.

Charts Give Contents of Cylindrical Tanks Without Computation

By E. Earl Glass
Monrovia, Cal.

CHARTS which give, without computation, the number of United States gallons of liquid remaining in any horizontal cylindrical tank when the depth of liquid is known, are shown in the accompanying illustrations.

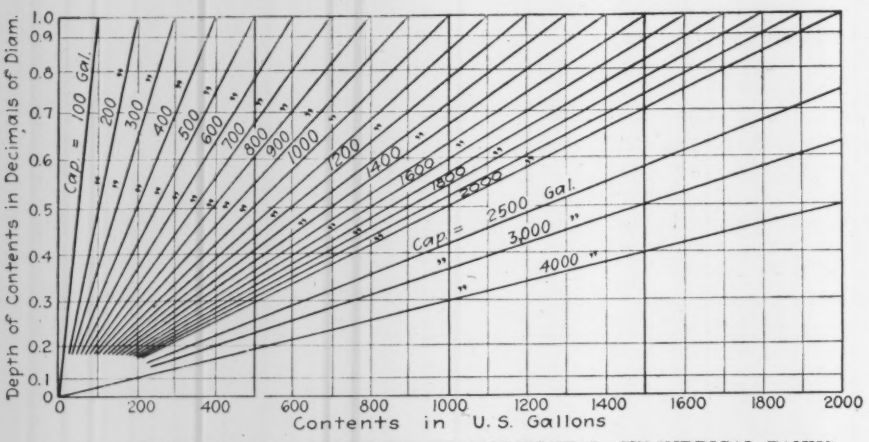


FIG. 1. CONTENTS OF PARTLY-FILLED HORIZONTAL CYLINDRICAL TANKS

One chart gives the total volume of any cylindrical tank when the diameter and length are known. The other shows the actual number of gallons in the tank in functions of the depth of contents in decimals of the diameter, and the total capacity in United States gallons. These charts have been found very convenient for the use of road-oiling inspectors, in determining the quantities of oil received upon the highways.

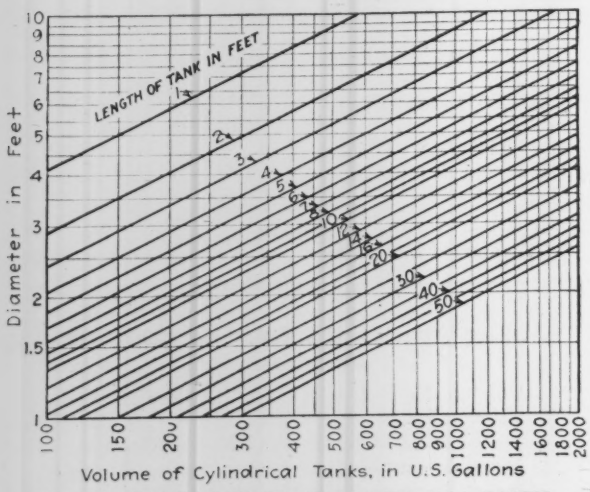
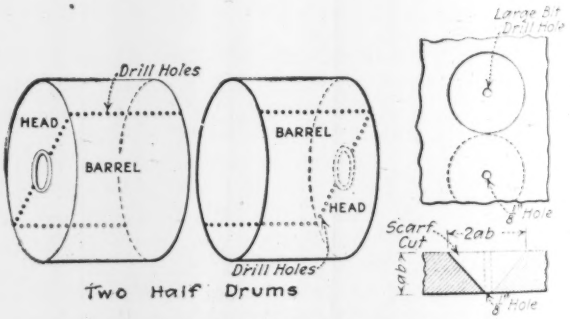


FIG. 2. TOTAL VOLUME OF CYLINDRICAL TANKS

As an example of the use of the charts, if the depth of oil in the tank is 3.4 ft., and the tank is 4.5 ft. in diameter and 9.5 ft. long, Fig. 2 gives its total capacity as 1130 gal. Dividing 3.4 by 4.5, the tank is seen to be 0.76 of the diameter full. For a tank having a capacity of 1130 gal. this decimal, as shown by Fig. 1, gives the contents as 920 gallons.

Mixer Drum Cut Into Quarters to Go Through Tunnel

CUT into four parts, two cast half-drums for a cubic yard concrete mixer are to be carried by cars through a 4 x 6-ft. tunnel four miles long and reassembled by oxyacetylene welding at the job on the opposite side of the mountain. As the drum is manufactured it is cast in the form of two half-drums, each with barrel and head in one piece. The method of cutting the half drums in two at the factory is indicated by the sketch, which, it is to be noted, is diagrammatic and does not depict the actual shape of the drum. Along the lines shown rows of ½-in. holes were drilled through the shell of the drum. Each hole was then enlarged by a drill having a bit width twice the thickness of the shell. This method of drilling gave in large measure the scarf needed in welding the parts together on the job. When the half-drums had been broken apart on the lines of the drilled holes the scarf was finished smooth with hammer and cold chisel. Assembling at the job is merely a task of welding, by the use of oxyacetylene, the halves of the half-drums. To prevent possible error



METHOD OF CUTTING HALF DRUMS IN TWO

in performing this task the drum parts were numbered at the shop in the order in which they are to be welded. Besides cutting the drum, the shop made up other parts of the mixer so that they could be dismantled into fractions which could readily be shipped through the tunnel.

The mixer was manufactured and prepared for shipment as described by the Oshkosh Manufacturing Co., Oshkosh, Wis.

NEWS OF THE WEEK

New York, October 3, 1918

Bridge Policy Outlined By Highways Council

Will Permit Only Urgently Needed Construction—Present Structures Should be Maintained

The United States Highways Council states that it considers only three classes of bridge projects as worthy of approval during the period of the war. These are bridges urgently required as military necessities and so recommended by the representative of the War Department to the council; replacement of unsafe bridges which cannot be made safe through suitable repairs, traffic regulations, or detours; replacement of bridges which have been destroyed and which are a direct or indirect war need.

In carrying out this policy, says the council, every endeavor should be made to keep existing structures in service by all available means, such as: (a) effective supervision; (b) suitable repairs; (c) control of traffic; (d) prohibition of the use of bridges by street car, road rollers, traction engines and other heavy vehicles. The possible relief of a weak bridge by a detour utilizing a safe structure should be investigated. The improvement of such a detour by using materials which can be obtained without serious delay may be preferable as a war-time measure to the reconstruction of a steel bridge.

Attention is also called by the council to the facts that in some sections of the country the urgent Government requirements for cement are now very heavy, and that materials like cement and brick cannot now be turned out in the same quantities as in peace time on account of fuel shortage. Consequently, public officials are not justified in changing their plans for proposed structures from steel to concrete.

If public officials find that it is impossible to maintain existing structures, and cannot substitute temporary bridges for those that are unsafe, they should apply to the United States Highways Council, using forms obtainable from their state highway departments, for approval of their projects. With each application there should be a statement of the size and date of construction of the bridge, the conditions of the piers and abutments, any stream conditions, such as floods or caving banks, which affect the maintenance or reconstruction of the bridge, the local materials available for bridge work and evidence of the impossibility of maintaining the present structure or substituting a temporary structure of materials obtainable without Government assistance. Public officials are reminded that the United States Highways Council looks to them for assistance in reducing to the absolute minimum the use of bridge materials required.

New Exceptions to Construction Rules of Industries Board

Highway and pavement constructions now substantially under way, and farm constructions not exceeding $1000 in cost, may proceed without permit by the War Industries Board, as exceptions to the general regulations governing building construction during the period of the war. The regulations were outlined in *Engineering News-Record* of Sept. 19, p. 557.

Construction projects for the production (but not refining) of mineral oil and natural gas may also proceed without special permit.

Place Highway Transport Employees in Deferred Class

Concerns engaged in the transportation within cities and along the public highways elsewhere of necessary commodities may claim deferred classification for their necessary employees under the provisions of the recent act of Congress referring to "persons engaged in industries, occupations, or employments, including agriculture, found to be necessary to the maintenance of the military establishment, or the effective operation of the military forces, or the maintenance of national interest during the emergency." The above statement was authorized by the War Department from the office of the provost marshal general.

In such cases, as in all others where claim for deferred classification is made on this ground, evidence must be submitted to the district board to show that the particular concern making the claim is included under the definition given above.

Preparing Chicago for Short Haul Embargo

The Illinois State Council of Defense expects to be in a position within the next few weeks to arrange for handling through return load bureaus all less-than-carload shipments by motor truck and trolley lines within a radius of 100 miles of Chicago. The Chicago Association of Commerce has requested its members to coöperate in developing a system of highway and trolley transport as a war time need and patriotic duty, and help to thus relieve the railroads of every ton of freight that can be carried otherwise.

Civil Engineers Wanted in the Navy

Men Between 25 and 35 To Be Commissioned as Junior Lieutenants—Examination Closes November 11

Temporary appointments as assistant civil engineer, Corps of Civil Engineers, United States Navy, with the rank of lieutenant, junior grade, to be made before the new year, will be filled from an eligible list to be established by an examination now open to qualified engineers between the ages of 25 and 35. The candidates must be American citizens who have received an engineering degree from a college or university of recognized good standing, and must have had not less than two years' practical experience since graduation. Those already in the service of the United States are eligible, but must obtain release from their present connection before appointment. Likewise, those subject to the selective draft must obtain releases from their draft boards.

The examination will be nonassembled. The procedure is, first to forward to the examining board, bureau of yards and docks, United States Navy, filled out, the blank shown below. This must be sent as soon as possible. The candidate will then address a letter to the board with the following data, to be sworn to before a notary: (1) Name in full; (2) Present address; (3) Legal residence (voting place); (4) Occupation; (5) Place and date of birth; (6) Height and weight; (7) Photograph (snapshot satisfactory). Mark at bottom of the front the date taken,

Bureau of Yards and Docks,
U. S. Navy Department, Examining Board,
Washington, D. C.

Gentlemen: Being desirous of a temporary appointment to the Corps of Civil Engineers, United States Navy, I am submitting herewith the following 6 names of persons who, from personal knowledge are conversant with my professional ability.

Name	Address
Mr.	.....
Mr.	.....
Mr.	.....
Mr.	.....
Mr.	.....
Mr.	.....

The following preliminary data are submitted:

Country of birth.....; when naturalized.....
Date of birth.....Married....Single....
Children .....
Health and physical condition.....
College from which graduated.....
Date of graduation and degree.....
Foreign languages, if any, spoken.....
read.....
Proficiency in what professional lines.....
Status in draft.....

.....
(Name, typewritten or printed)
.....
(Address)
.....
(Town and State)

height and weight; (8) Evidence of American citizenship (birth certificate or affidavit as to native birth or naturalization); (9) College or university from which graduated, date of graduation, course pursued, length of course, and degree conferred; (10) Testimonials in regard to character and moral fitness; (11) Testimonials from employers covering the candidate's professional experience and ability; (12) Chronological statement in detail of professional experience; (13) Six names of persons who, from personal knowledge, are conversant with the candidate's professional ability. The six names given here should be the same as those on notification blank.

Further examination may be required, in which case the candidate will have to go to Washington at his own expense. The medical examination is taken at the nearest Navy station. Those passing will be put on the elegible list from which at least 17 appointments will be immediately made. The pay and allowances of the rank amount to about $2500 a year. The commissions will continue until the war ends.

Reserve civil engineers and persons on the eligible list for enrollment in the civil engineer corps, United States Naval Reserve Force, need not submit further records, if their records are on file with the bureau; however, it is necessary that they write a letter to the examining board stating that they wish to be considered for this examination. Men who entered the similar examination last December and whose papers have been returned may enter the present examination without prejudice.

Buffalo Committee Reports on Garbage and Refuse

A call for bids for the separate collection of the garbage and refuse of Buffalo, and for still other bids for the disposal of each, has been recommended by a committee consisting of John A. Saurers, superintendent of the Bureau of Sanitation; F. R. Booth, of the Division of Investigation, and J. C. Slippy, chief accountant of the Bureau of Costs. The committee, whose report is addressed to the mayor and council, was appointed to investigate methods and costs of garbage collection in American cities. After a trip to various cities it submitted a report consisting of notes and tables, the recommendations just stated, an expression of preference for municipal collection, doubt as to the best method of garbage disposal, but certainty that utilization of some kind should be practiced and that the present practice of refuse sorting and utilization should be continued by someone.

Dominion Government Buys Bulk of Canadian Northern Stock

Payment of $8,500,000 has been made by the Canadian Government for the 510,000 shares of common stock of the Canadian Northern Ry. held by the Mackenzie-Mann interests. This is in accordance with the parliamentary act covering the acquisition of the road by the Government. There remain in other private hands 90,000 shares, which are to be paid for at $18 per share, the figure fixed last May by the board of arbitration.

Notes from the Field

A ROMANCE OF THE WAR

There are many romances of the war: the conversion of a peace-loving nation to a fighting people; the sending 3000 miles overseas of an army of a million and a half—unprecedented in history and ranking beyond all military expeditionary movements from the Trojan and Xenophonian expeditions down; the building of a merchant marine in a few years that would have required a generation before. Besides these are the creation of new industries—like the Government's explosives plants, private and Government shell plants, the building of the big-gun plant on Neville Island, and conversion of existing plants to hitherto unthought-of uses.

The enumeration might go on indefinitely, but these are nationally known romances. Others there are hidden in out-of-the-way corners, local enterprises, whose romance is known to the few, but whose influence is nevertheless national. One of these is that of the Coors pottery at Golden, Colo.

Little was it thought, when a potter without funds came to Golden for his health and experimented with the local shales and clays as a basis for art pottery, that an industry might result that would play a part in a great war. There was no demand locally for art pottery, and the plant experimented with fireproof baking and cooking ware. Several years ago the thought of making chemical porcelain, to replace the standard German ware then off the market, occurred to the managers.

And then, just when progress was sufficient to justify earnest work to build an industry, the potter left. He was the only ceramist in the plant. But the owner, Coors, was not to be turned back. Investigation of the chemical industry by Charles F. Quaintance, president of the Chamber of Commerce of Golden, had shown the commercial possibilities of the ware. Mr. Coors' three sons were well trained chemists, Cornell graduates, and they undertook the task of developing the product.

They faced not only endless experiments with body material, glazes, methods of burning, etc., but had to design, develop and construct praetically all the machinery and equipment needed. Some of the coarser machinery—grinding machinery, for example—was on the market, but all other pottery equipment was far too crude for the high-grade ware which the Coors set out to make. "Coors," they determined, should be the world's standard in chemical porcelain.

Fortunately, the work was crowned with success, though the failures were many, the rays of hope infrequent. It cost the health of one of the sons, but failure, he would probably say, would have been even a worse result—failure to attain an ideal, more serious even than financial disaster.

Today the ware, so qualified chemists state, is without a superior. And yet, with the spirit of true scientists, the Coors are not satisfied. Their research department is constantly at work and, on request of the Government, recently turned out electrolytic porous cells of exceptionally long life, and, more recently, pots for melting optical glass. Experiments on the production of the porcelain part of spark plugs to stand severe tests are now under way.

Other porcelain manufacturers have made progress in chemical ware since the war began, and their efforts are not to be belittled. But no matter what the efforts of others, the pioneering work of the men who without ceramic training or experience worked out through heart-breaking failures a ware that can make us independent of Germany for all time deserves recognition.

Just another romance of the great war.

E. J. M.

Wooden Ship Built in 17½ Days

Rapid work on a wooden ship has been done by the Grays Harbor Motorship Corporation, Aberdeen, Wash., as reported to the Emergency Fleet Corporation during the past week. A ship of 4000 tons dead-weight carrying capacity was built in 17½ working days.

Will Discuss Many Phases of City-Manager Plan

The program of the 5th annual convention of the City Managers' Association, to be held at Roanoke, Va., Nov. 6-8, will include discussions of a wide range of subjects dealing with the commission-manager plan of city government. On the first day of the meeting Charles E. Ashburner, Norfolk, Va., past president of the association, will deliver a paper entitled "The Ten-Year Test of the City-Manager Plan." On the same day, it is also expected, papers will be read on "Establishing and Maintaining Commission-Manager Government" and "The City's Relation to Law Breakers."

On the second day of the convention Richard S. Childs, of the War Department, Washington, will deliver an address under the title, "Uncle Sam's Call to City Managers." It is planned to devote the afternoon to an inspection trip through Roanoke and its vicinity.

The morning session of the last day of the convention will be largely given over to a discussion of the duties and problems of the city manager with respect to the finance, safety, welfare, service and utilities departments. The afternoon session of the same day will include an address, by O. E. Carr, Springfield, Ohio, entitled "Progress, Prospects and Pitfalls of the New Profession." Myron H. West, Chicago, will speak on "City Planning for After-War Conditions." The closing business session will be held on the same day.

More Districts Wage War on the Mosquito

Two New Jersey Counties Join Forces Against Pest in Shipbuilding Areas —Plan for Next Season

Camden and Gloucester Counties, in New Jersey, have entered into joint control of the mosquito warfare being waged in the districts around the shipyards on the New Jersey side of the Delaware River, the warfare against the pest being conducted on the lines described in *Engineering News-Record* of Sept. 12, p. 513. In that issue it was told how local authorities are coöperating with the United States Shipping Board in fighting the disease-carrying mosquito. The New Jersey campaign was launched by the Department of Health and Sanitation in coöperation with the State of New Jersey. In this district are two large shipyards and various plants engaged in war industries. The work is being done under the direction of L. F. Cushing, whose salary is paid by the State of New Jersey. It is expected that conditions will be improved so that night work now necessary at most of these plants can be conducted hereafter without annoyance and loss of efficiency due to mosquito pests.

At Chester, Penn., which is an important center of shipbuilding and other war work, the State Department of Health called a meeting of representative industries and a committee was appointed. The support of the Emergency Fleet Corporation has been obtained, following a conference with Howard Coonley, vice-president, and the state has agreed to appropriate $40,000 if $60,000 can be obtained from other sources. Chester expects to spend $100,000 on the project.

The health and sanitation section has actively enlisted the aid of the City of Wilmington, N. C., in mosquito elimination, and private interests have promised funds for the work. This work is considered especially important in the vicinity of the concrete shipyard of the Liberty Shipbuilding Co., as it is expected soon to inaugurate night work there. The steel shipyard of the North Carolina Shipbuilding Co., also in Wilmington, has been included in this campaign. A fund of $30,000 has already been raised in the city.

A mosquito survey has been made in the vicinity of the yard of the Virginia Shipbuilding Co., Alexandria, Va., and recommendations sent to the company by the health and sanitation section.

A survey of conditions has been made in the Gulf of Mexico yards. The mosquito pest is very bad in this district as many of the yards are near a great deal of stagnant water.

In Los Angeles, Cal., fish-canning companies have donated a force of 100 men for work of mosquito elimination under the direction of the State Board of Health. The health and sanitation section of the Industrial Relations Group is endeavoring to organize a mosquito abatement district to cope with the situation next season.

Commission Permits Construction of Weir in St. Lawrence

The International Joint Commission has granted permission to the St. Lawrence River Power Co. to build a temporary submerged weir in the South Sault channel of the St. Lawrence River near the entrance of the company's power canal leading to the power house at Massena, N. Y. The grant was opposed by the Canadian Government on the ground that the construction of the weir would interfere with navigation in the channel, in contravention of established treaties, and that the construction would permit certain control of this international waterway to pass into private hands, which is contrary to public policy. The commission upheld the claim of the company that the weir is necessary to the increased production of aluminum, which is a needed war material. The order allows the weir to remain for five years or until the end of the war, whichever is the latest date, and retains control of the structure in the commission.

Authorize Naval and Marine Sections of Training Corps

Naval and marine sections of the Students' Army Training Corps have been authorized at designated institutions by the committee on education and special training of the War Department. Quotas for the naval section have been assigned to a large number of institutions in practically every state. Marine sections of the corps will be organized at Leland Stanford University, the Georgia School of Technology, Harvard University, the University of Minnesota, Cornell University, the University of Washington, the University of Texas, Yale University, the University of Kansas, the University of Wisconsin, the Virginia Military Institute and the University of North Carolina.

Head of Canadian Northern to Continue Under Government

D. B. Hanna, who has been operating executive of the Canadian Northern Ry. since 1896, has been retained as president by the Dominion Government, which recently acquired most of the stock. C. J. Mitchell, of the old board of directors, will continue as a salaried executive director, and Maj. Graham Bell, acting deputy minister of railways, will represent the Government in questions of policy. Five new directors have been appointed.

This arrangement is regarded as a temporary expedient, pending the nationalization of other Canadian railroads and the establishing of a single Government system in accordance with the recommendations of the Drayton-Acworth report.

More Engineers Study Cut-Over Lands and Drainage

Reclamation Service Engages and Transfers Men for Various Sections of Country

Progress is being made in the creation of a staff to conduct the investigation of drainage and cut-over lands, outlined in our issues of Aug. 22, p. 361, and Sept. 5, p. 469. For the Southern district, which is in charge of H. T. Cory, D. W. Ross has been engaged. His headquarters will be at New Orleans, and he will give attention to the work in Texas, Louisiana and Mississippi. When the United States Reclamation Service began work, Mr. Ross was state engineer of Idaho. He left that position to take charge of Service work in Idaho and its vicinity. He had charge of the construction of diversion works in the Snake River, Minidoka, Idaho. He left the Reclamation Service about eight years ago, since which time he has been in private work, more recently with an office in San Francisco as consulting engineer.

In the Northern district, F. W. Hanna has added to his staff P. M. Fogg and H. J. Gault, who are now in the field in the middle Western states. Mr. Fogg was with the Reclamation Service most of the time for 10 years. He was in charge of the Minidoka project in Idaho after its completion, and has written papers on operation subjects. Mr. Gault has been in the employ of the Reclamation Service for some time past. For a few years he was on the Rio Grande project, where he had charge of dam and canal construction. For the investigation of cut-over lands in the far Northwestern states there has been employed, also under the direction of Mr. Hanna, Walter H. Graves, who has been engaged in similar work for many years as consulting engineer, with an office in Portland, Ore.

In the Western division, which embraces the whole arid region, F. E. Weymouth will depend largely upon the men already under him in the Reclamation Service. The only addition to his staff thus far is Homer Hamlin, formerly engaged on the Yuma project of the Reclamation Service and recently, for a number of years, city engineer of Los Angeles.

For service in the Washington office and possibly some field work in Virginia, E. C. Vincent has been employed. He was formerly an engineer in the Reclamation Service in charge of the Laguna dam on the Lower Colorado.

Mount Royal Tunnel Opened

After a final inspection by the engineering staff of the Canadian Railway Commission, the Mount Royal tunnel at Montreal, the last link of the Canadian Northern Ry. system between that city and Vancouver, was officially declared open to traffic Sept. 21. The tunnel, which is double-track and 3 miles long, was six years under construction and

Engineer Officer Decorated for Conspicuous Gallantry in Action

LIEUT. A. C. HAWKES, FIRST ENGINEERS, FIRST DIVISION, BEING DECORATED WITH THE DISTINGUISHED SERVICE CROSS

San Francisco Plans Port Improvements

Plans for the complete development of the India Basin-Islais Creek section of the San Francisco waterfront, recently prepared by F. G. White, chief engineer of the California State Board of Harbor Commissioners, have been accepted by the board. As the first unit of construction, which will fit in with a general scheme for improvement Mr. White recommends that the India Basin work be begun immediately. It would consist of (1) a seawall and wharf along the south side of the Islais Creek channel, to a point about 2400 ft. east of Third Street; (2) fill at least 400 ft. in width back of the seawall; (3) wharf shed 100 ft. in width and two-story warehouse, 200 ft. in width, on the wharf and filled ground parallel with the channel; (4) extension of railroad tracks to serve the warehouse and wharf.

According to this plan, provision will be made for the establishment of a new waterfront line 1500 ft. inshore from the existing pierhead line. This will permit of the construction of long piers and a location for the seawall approximately along a line where the bottom breaks off into deep water.

Eight piers are to be constructed, 235 ft. wide and 1000 ft. long, covering a total area of 1,964,000 sq.ft., together with eight warehouses, each with a total area of 300,000 sq.ft. on one floor.

Building of a coaling pier, a wharf for storage purposes, an engine house, shops, etc., for the belt railroad is also contemplated. That portion of the tract which is to be laid out as an industrial district covers 34.5 acres and is to be divided into 31 blocks, all served by railroad tracks and all facing on streets extending directly to the waterfront.

Early Summarization of Proposed Highway Work Desired

Instructions and forms have been sent out by the United States Highways Council, setting forth the manner in which proposed highway work for the year 1919 must be summarized and sent to the council. Several of the states have already begun the summary, with the idea of having it in the hands of the council by Oct. 20, but the council announces that it will be sufficient for its needs if it has the information on or before Dec. 10, and requests that all the state departments endeavor to present it by that time.

The instructions set forth in detail how the forms should be made up. A separate set of schedules is to be submitted for state, county, township and municipal work, respectively, thus making four sets of schedules. Each set of schedules is divided into construction, reconstruction and maintenance, thus making 12 schedules in all, and it is requested that a fourth class be added, to be known as resurfacing, making the entire report, if each set of schedules involves all four classes of construction, consist of 16 schedules. The forms provided are not designed to be sent out to the subdivisions, but are for a summary of the returns made to the state highway departments by the various counties, townships and municipalities. As far as practicable, the council desires the state to send maps with the various projects marked upon them.

As it is realized that all information and authorizations for projects could not be presented at this time, this report is intended to represent the approximate intention of the authorities in case the projects are approved. In fact, it is merely preliminary to a formal application that must be ultimately submitted for each project.

Markets Bureau Coöperates With Motor Truck Routes

Coöperation with responsible operators of motor-truck routes is offered by the Bureau of Markets, United States Department of Agriculture. Operators who agree to work according to the most approved method, and to conform to the general requirements of the bureau, will receive the advantage of advice and information developed through the bureau's investigations, and will receive signs to display on their trucks, stating that they are cooperating with the Government.

Through this coöperation the Bureau of Markets hopes to make it easy to place in proper hands such advice and information as it may obtain; to act as a medium for distribution of information among operators; to stabilize the rural motor business by requiring adherence to certain business practices, and to give reliable operators the business advantage of working with the bureau. The requirements laid upon the truck operators are the maintenance of dependable service and schedules; just

rates based on cost plus a reasonable profit; the furnishing of satisfactory records of operating costs to the bureau; the use of uniform approved bills of lading and the providing of adequate insurance for shipments. No attempt to exercise arbitrary authority or to insist on practices detrimental to properly conducted motor-truck routes is intended. Application blanks for obtaining this coöperation may be had from the chief of the Bureau of Markets, United States Department of Agriculture, Washington, D. C.

Contract Let for Motor-Truck Transportation of Coal

Motor-truck transportation of coal from the mines directly to the consumer has been contracted for by the Birmingham (Ala.) Civic Association, working in conjunction with the County Board of Revenue and the Board of City Commissioners. The contract was closed recently with the Jenkins Motor Co., and the company has agreed to establish two motor-truck lines, to move 200 tons of coal daily. This is reported to be the most extensive utilization of motor-truck transportation, for the hauling of coal from the mines to the consumer, in the United States.

The plan contemplates the establishment of a municipal coal yard to supply domestic trade, and this will be in readiness as soon as the movement of coal starts. To facilitate the movement of the trucks the County Board of Supervisors has passed a resolution authorizing the construction of 4 miles of public highway, and the mine owners and operators will spend, according to reports, several thousand dollars immediately in the construction of two additional miles, connecting the mines with the main highway.

Two fleets of trucks will be immediately purchased by the contractor at an estimated cost of $30,000, and these are expected to add not less than 50,000 tons to the city's winter coal supply.

Coal operations utilizing motor trucks for transportation will be watched with much interest throughout the country, and it is reported that the local fuel administration will make every effort to encourage this method of relief of the railroads.

Society Directory Gives Training and Experience of Members

Classified tables of members compiled on the basis of experience are contained in the first directory put out by the American Association of Engineers. This 6 x 9-in., 190-page, volume is designed to be of definite usefulness to the employer of engineers, who will be able to learn of an engineer-applicant's experience without unnecessary interviews. From the classification, 71.9% of the members have civil engineering experience, 24.8% mechanical, 12.8% electrical, 5.7% mining and 2.9% chemical engineering experience. According to experience the division is as follows: Consulting (practicing engineers), 10.3%; contractors, 1.2%; executives (officials, managers, superintendents, etc.), 40.4%; assistants, draftsmen, etc., 42.5%; students, 5.1%.

More than 20% of the members are in the army service, 421 being the number on July 1. Analysis shows 2 colonels, 2 lieutenant colonels, 15 majors, 47 captains, 107 lieutenants, 21 men in officers' training camps, 24 noncommissioned officers, 142 privates, 61 no information. By far the greater number are in the engineer corps, 168; but 33 are in the signal corps, 11 in ordnance, 12 in aviation, 20 in artillery, 72 in the infantry and 26 in the navy.

That the organization is composed of young men mainly is shown by the fact that on Jan. 1, 1918, of the total applications received (not members admitted), only 41.4% were from engineers above 32 years of age. The membership is wide spread over the country, only two states, Nevada and Maine, not having representation.

New Railroad Devices Will Be Examined

Division of Operation Issues Rules for Submitting Improvements to Track and Equipment

Rules governing the submission of devices or inventions to the United States Railroad Administration for investigation have been issued by the director of the Division of Operation. Complete specifications and detailed drawings, showing fully and clearly the construction, application and method of operation of the device or apparatus, must be submitted. The drawings should preferably be on sheets not larger than 8 x 10½ in. Larger drawings must be multiples of this size.

The plans and specifications should be accompanied by a statement showing (1) the name of the appliance or device; (2) the name and address of the proprietor; (3) the number and date of United States patent or patents; (4) the purpose of the appliance or device; (5) a brief statement of how the purpose is carried out; (6) a general description; (7) a statement of its relation to other appliances; (8) the name of the railroad or railroads on which used or tried, and length of time in use; (9) the name of the town, district or railroad division where used or tried; (10) the name of railroad officers of whom inquiry may be made.

Plans or other descriptive matter submitted will not be returned. Models need not be submitted, but may be, at the proprietor's risk and expense. They will be returned only if the proprietor so requests. Whether or not models are submitted, complete detailed plans and specifications must be furnished. When they have been examined the person submitting the device will be informed of the results of the examination and the conclusions reached.

Correspondence relating to roadway or track appliances should be addressed to United States Railroad Administration, C. A. Morse, assistant director, Division of Operation, Engineering and Maintenance, Washington, D. C. Correspondence relating to appliances for locomotives or cars should be addressed to United States Railroad Administration, Frank McManamy, assistant director, Division of Operation, Washington, D. C.

Labor on Army Work Under Special Board

Announcement has been made of the appointment by the Secretary of War of the Emergency Construction Wage Commission, which is in effect the successor of the old Cantonment Adjustment Commission. This original commission had charge of the adjustment of all labor disputes on the cantonments, but by a recent order of the War Department, the jurisdiction has been extended to embrace all other construction work which may from time to time during the war be carried on by the War Department. The change in name was therefore ordered. To the Emergency Construction Wage Commission has been assigned responsibility for the adjustment and control of wages, hours and conditions of labor in all Army construction work. The personnel consists of three persons appointed by the Secretary of War, one to represent the Army, one the public, and one to represent organized labor. At present the commission is constituted of E. M. Hopkins, chairman, representing the public; Col. J. H. Alexander, representing the Army, and J. R. Alpine, acting president of the American Federation of Labor, representing organized labor.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN PUBLIC HEALTH ASSOCIATION; 126 Massachusetts Ave., Boston, Oct. 14-17, Chicago.

CITY MANAGERS' ASSOCIATION; Harrison Grey Otis, Auburn, Maine, secretary-treasurer; Nov. 6-8, Roanoke, Va.

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS; A. Dennis Williams, Morgantown, W. Va., acting secretary; Dec. 2-6, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS; 29 West 39th St., New York City; Dec. 3-6, New York.

The New York Section of the American Society of Mechanical Engineers witnessed a double ship launching Sept. 28 on a trip to the yard of the Standard Ship Building Corporation at Shooters Island, in Newark Bay. The party numbered several thousand. Two 7500-ton steel ships, the "Monmouth" and the "Dallas," went down the ways. The occasion was made especially interesting to the party by the placing

of the observation stands close alongside the keel at the bow of the "Dallas," so that the launching operations—wedging up, knocking out shores, placing jacks, sawing the tie-piece and starting the ship on its slide—could be seen at close range.

The Western Society of Engineers, Chicago, was addressed Sept. 23 by William G. Edens, president of the Illinois Highway Improvement Association on "Good Roads in Illinois." Mr. Edens explained the proposed $60,000,000 bond issue, to be voted on Nov. 5. Stress was laid on the part engineers can play in promoting this program for after-the-war work, as under the terms of the proposed issue the bonds are not to be sold until after the war. The photoplay, "Through Illinois Over Unchanged Roads in a World of Change," taken in celebration of the Illinois centennial, was shown.

The Hamilton, Ont., Branch of the Engineering Institute of Canada was organized at a meeting held Sept. 21, with E. R. Gray, city engineer of Hamilton, as chairman, and H. B. Dwight, of the Canadian Westinghouse Co., as secretary. P. M. Lincoln, of the Westinghouse Electrical & Manufacturing Co., Pittsburgh, addressed the meeting on "The History and Development of Electric Power and Transmission." He dealt with civil engineering phases of the subject. Other speakers were H. U. Hart, C. H. Hutton and L. W. Pratt.

The Technical Societies of Chicago were addressed by Col. Peter Junkersfeld of the Construction Division, United States Army, Oct. 1, on "Emergency Construction for the War Department of the United States." This was the second meeting of the war committee, which is composed of representatives of 19 organizations.

The Kansas State Irrigation Congress held its seventh annual meeting at Garden City Oct. 1-2. Among the subjects discussed were "The Future of Western Kansas Irrigation"; "Comparison of Local Irrigated with Non-irrigated Crops"; "Small Irrigation Plants"; "Central Power Plants for Irrigation"; "Farm Loans and Irrigation in Western Kansas," and "Lessons from Irrigation Development in the West."

The Engineers' Club of San Francisco was addressed at a meeting on Sept. 19 by J. R. Geary, who spoke on "Sidelights on Japan by an American Business Man." Mr. Geary has represented the General Electric Co. in Japan for fifteen years, with headquarters at Yokohama.

The Iowa Section of the American Water Works Association will hold its fourth annual meeting in Iowa City, Oct. 23-24. Arrangements for exhibits are being made by W. H. Hostetler, superintendent of the Iowa City Water Company.

PERSONAL NOTES

C. ARTHUR POOLE, city engineer, and John F. Skinner, principal assistant city engineer of Rochester, N. Y., have been commissioned as captains in the Corps of Engineers and the Construction Division, respectively.

H. N. SAVAGE, who has represented the city of San Diego in the construction of the new dam at Lower Otay, has recently been given entire charge of the work, subsequent to the abrogation of the contract with James Kennedy by the city. Mr. Savage's authority extends to laying out and directing a day-labor and force-account plan for rushing the work to completion, in order to catch the run-off of 1918-19.

E. H. LEE, vice-president of the Chicago & Western Indiana R.R. Co., and chief engineer of the Belt Ry. of Chicago, has been elected president of both companies.

FINLAY MACFARLAND has been appointed president and general manager of the Denver water plant. As noted in *Engineering News-Record* of Aug. 15, p. 336, Mr. MacFarland was a member of the board of five citizens selected by the city government to manage the plant of the Denver Union Water Co. after it was taken over by the city in accordance with the election held Aug. 6.

A. B. EDGE, district engineer of the Georgia R.R., the Atlanta & West Point R.R. and the Western Ry. of Alabama, with headquarters at Atlanta, has resigned to enter the Engineer Officers' Reserve Corps with the rank of captain. He has been assigned to duty at Camp A. A. Humphreys, Virginia.

WILLIAM E. DUCKERING, for the past four years assistant professor of civil engineering, University of Washington, Seattle, has been commissioned as first lieutenant in the Engineer Officers' Reserve Corps and assigned to duty at Camp A. A. Humphreys, Virginia.

FRANK I. BENNETT, commissioner of public works of Chicago, has resigned to become commissioner of public works for the State of Illinois, by appointment of the Governor.

GEORGE F. WEIGHARDT, assistant water engineer of Baltimore, who was recommended by the Mayor for appointment as highways engineer and member of the Board of Estimate, now officially becomes highways engineer through confirmation of the appointment by the City Council. Since his graduation from Cornell in 1909 Mr. Weighardt has been almost continuously engaged in municipal engineering work.

P. T. ROBINSON, assistant division engineer of the Southern Pacific Co. at Los Angeles, has been promoted to division engineer at Bakersfield, Cal. He is succeeded by E. H. Miller.

DAVID J. HOWELL, of the firm of David J. Howell & Son, civil engineers, Washington, D. C., has been appointed general manager of the Alexandria Water Co., Alexandria, Va. Mr. Howell will continue in private practice in Washington.

R. E. HARRISON has been appointed acting sanitary engineer of Lucas County, Ohio, succeeding Louis A. Boulay, who has been commissioned as captain in the Engineer Officers' Reserve Corps.

G. W. CORRIGAN, division engineer of the Southern Pacific Co. at Bakersfield, Cal., has been transferred to Los Angeles, succeeding W. M. Jaekel, promoted.

PAUL SULLIVAN, assistant city engineer, Cincinnati, has been commissioned as first lieutenant in the Engineer Officers' Reserve Corps. It is expected that no successor to Mr. Sullivan will be appointed, in accordance with the city engineering department's policy of economy.

D. J. KERR, office engineer of the Great Northern Ry., has been appointed corporate engineer for the company.

LUCIUS E. ALLEN, consulting engineer, Belleville, Ont., has been appointed consulting engineer, nitrate division, ordnance department, United States Army.

H. S. FREEMAN, chief draftsman of the Great Northern Ry., has been appointed office engineer, succeeding D. J. Kerr, who has gone with the corporation.

OBITUARY

DANIEL C. TOAL, editor of the *Water and Gas Review*, published in New York City by the National Meter Co., died at his home in Brooklyn Sept. 24, at the age of 76. Mr. Toal was born in New York and served through the Civil War in the 71st Regiment, New York Volunteers. He was educated at St. Francis Xavier College and the College of St. Sulpice, Montreal.

NEWS OF ENGINEERING INDUSTRIES

FOR MANUFACTURERS WHO SERVE ENGINEERS AND CONTRACTORS

Coal Drive Started by Fuel Administration

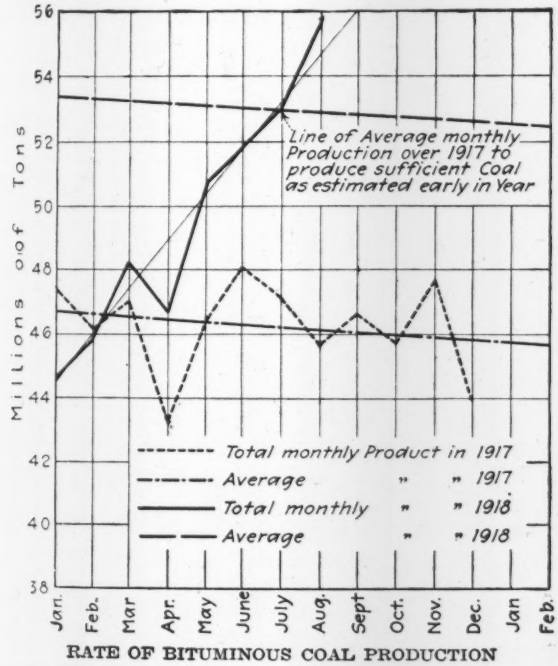
Constant Rate of 12,234,000-Ton Production from Bituminous Mines Called for to Avert Famine

A drive which will continue till Apr. 1, 1919, to produce 12,234,000 tons of bituminous coal and more than 2,000,000 tons of anthracite coal per week, has been launched by Fuel Administrator Garfield. These amounts represent an increase of 1,731,000 and 121,000 tons of bituminous and anthracite coal, or 16⅔ and 6⅔%, respectively, over that of last year. These correspond to the estimates made early in the year.

The proclamation has been sent to the district production managers, who will consult with the mine production committee and apportion a weekly quota to each mine.

Coal production during the first part of September shows a decline, although some of it was due to the holiday. Although the accompanying diagram shows an increase over the previous two months, which is probably the result of President Wilson's proclamation it is not yet sufficient to balance the decline or flattening out of the curve that will occur when winter sets in. Economy must therefore continue.

The estimated requirements for the year as made in the spring have been so far exceeded as to raise the average line in the diagram and place a different aspect on the previous production. The production of steel is already so low as to threaten war industries, and the coal situation still further threatens the steel supply. Since the last coal article appearing in *Engineering News-Record*, for Aug. 15, the reported shortage of by-product coal essential to steel production has reached alarming proportions, according to the Fuel Administration. Every ton of this grade of coal is being taken for the war industries, and the industries deprived of their supply will be forced to use other grades of coal.



RATE OF BITUMINOUS COAL PRODUCTION

Production for the year to date is approximately 17,000,000 tons behind the requirements as outlined by the United States Fuel Administration. The average weekly production for the past eight weeks is approximately 12,300,000 tons, which in the season for maximum production is but slightly more than the amounts set for the drive to continue through a season of adverse mining conditions.

The consumption in a few of the better known activities illustrates the tremendous demand made on the industry. Every time a 15,000-ton troopship carries American soldiers to the fighting front in France it consumes about 3000 tons of coal or 12,000 bbl. of fuel oil, according to information recently published by the United States Fuel Administration in a booklet entitled "Fuel Facts." Continuing, it states that "more than 4,000,000 tons of coal are consumed in a year in transporting the supplies which must go forward in a continuous stream to maintain a single army. Our present shipbuilding program will demand 14,000,000 tons of coal merely to manufacture and transport the steel to be used in ship construction; and, in building 8,000,000 tons of vessels, we will use nearly five tons of coal for every ton of shipping that leaves the ways. Every 3-in. shell fired from an American gun in the war against autocracy represents 80 lb. of coal used in its manufacture, and these shells are being manufactured by the million."

Trade Catalogues Wanted in Australia and New Zealand

A request for trade catalogues, journals and magazines for use in the City Public Library of Sydney, Australia, is sent to the American public by W. H. Ifould, librarian, through the American consul general at Sydney.

Mr. Ifould says that the publications of especial interest are those relating to chemicals, machinery, hardware, steel products, textiles, construction of boats, motor cars, motor car accessories, etc., and says that on account of the frequent requests for such literature made at the library it is believed that the placing of such literature would afford an excellent opportunity for American manufacturers and exporters to get in touch with the Australian commercial public.

The American consul general at Auckland, New Zealand, reports that a special technical and commercial department has been added to the Canterbury Public Library at Christchurch, New Zealand, for the use of the public in that district. The chief librarian has appealed to the American consul general for such literature relating to the trade and commerce of the United States as may be procurable. The literature will be displayed in a prominent position in the library. It may be sent either through the American consulate or directly to the librarians mentioned.

Machinery Salesman Describes Watery Tunnel Ride

Construction plants and all construction materials, except those indigenous to the district, used in building the Gibraltar dam for the water supply of Santa Barbara, Cal., must go through a 4 x 6-ft. tunnel about four miles long. A machinery salesman recently visited the work and reported his experience in the tunnel. The work, known as the Gibraltar dam, is located about eight miles from the City of Santa Barbara, Cal., on the Santa Ynez River. It contains 50,000 cu.yd. of concrete and, owing to the peculiar location and difficult conditions of operation, it will take about two years to complete the job. All of the machinery, cement, men, form lumber and all supplies, except rock, sand and water, had to be hauled from Santa Barbara over a mountain road to a point four miles from the work, where it had to be loaded on small cars and taken through a tunnel 4 ft. wide by 6 ft. high and four miles long. A small railroad track and the water supply of the City of Santa Barbara also pass through the same tunnel, the water running about 3 in. above the tops of the rails, all the way

through. The material is transported by a waterproof electric locomotive drawing three small flat cars. The salesman states that "it is great sport making this tunnel trip, as we have to put on hip boots, rubber coats and rubber hats, and leave all of our regular clothing, money and hope behind when we start. We have to lie down on the cars to keep our heads from hitting the trolley wires, and with the train running through the water you can imagine what a beautiful shower we have playing over us all the way." The contractors for the dam are Bent Bros. & Cramer.

Patrol System Maintains Motor Truck Efficiency

A motorcycle patrol service, whereby a fleet of motor trucks is kept under constant inspection without interrupting operation, and at small cost, has been inaugurated by the president of the Federal Motor Truck Co., St. Louis, Mo. A competent mechanic provided with a motorcycle covers first a regular route in the wholesale commission merchants' and produce market sections, and, later in the day, other sections where trucks operate.

Whenever a Federal truck is encountered he inquires of the truck driver how the truck is running, and makes an inspection of its working parts without holding up the haulage work any more than necessary. Such

MOTOR TRUCK INSPECTOR TAKES NOTES

slight adjustments as the tightening up of the fan belts and other operations that may be made on the spot are effected and, should there be any adjustment on the car or slight repairs that the inspector is unable to make, or should he detect serious trouble, it is noted on a report blank, made out as soon as the inspection is finished. The reports are turned in each night, and the next morning are sorted and inclosed with a letter to the owner of each truck, calling attention to the adjustments made on the road and making recommendations when the items on the reports mentioned require especial attention. The owner is notified when his truck can be taken care of in the service station, and he is requested to leave the truck there at that time if possible.

The idea of the patrol service is based on the principle that a large percentage of truck troubles arise from the neglect of small repairs and adjustments.

FEDERAL TRUCK CO. OF ST. LOUIS

8-15 1918 Beal
Date Inspector

Owner H. T. Manning

Driver Bill Sykes

Items marked (1) were inspected by me and found satisfactory
Items marked (Q) required attention and were adjusted
Items marked (X) will require shop attention.

ENGINE	1	Steering Knuckles Right	1
Starting Crank Test	1	Steering Knuckles Left	1
Connecting Rods	1	Steering Arms	1
Main Bearings	1	Brakes—Service, Condition	1
Crank Bearings	1	Brakes—Emer., Condition	1
Wrist Pins	1	Truss Rod	1
Cam Gears	1	Radius Rod	1
Push Rods	1	Clutch	1
Valves	Q	Axle, Front	1
Valve Springs	Q	Axle, Rear	1
Governor	1	Springs, Front	X
OILING SYSTEM	1	Springs, Rear	1
Leaking Crank Case	1	Cross Con. Tube	1
Leaking Transm. Case	1	Spring Hanger	1
COOLING SYSTEM	1	Sprockets	1
Radiator	1	Chains	1
Pump	1	Propeller Shaft	1
Connections	1	Wheel Bearings	1
Fan	Q	Hubs	1
Fan Bearings	1	Oil Cups	Q
Fan Belt	Q	Grease Cups	1
CARBURETOR	1	Shifting Rod Pins	1
GASOLINE Feed Pipe	1	Gear Shift	1
TIRE	1	Transmission	1
IGNITION SYSTEM	1	Universal Joints	1
Magneto	1	Spring Shackles	1
Spark Plugs	Q	Front Wheel	1
Wiring & Connections	1	Rear Wheel	1
Steering Gear	1	Frame	1
Steering Arm	1	Truck Generally well taken care of	yes

One leaf front (right) spring cracked.

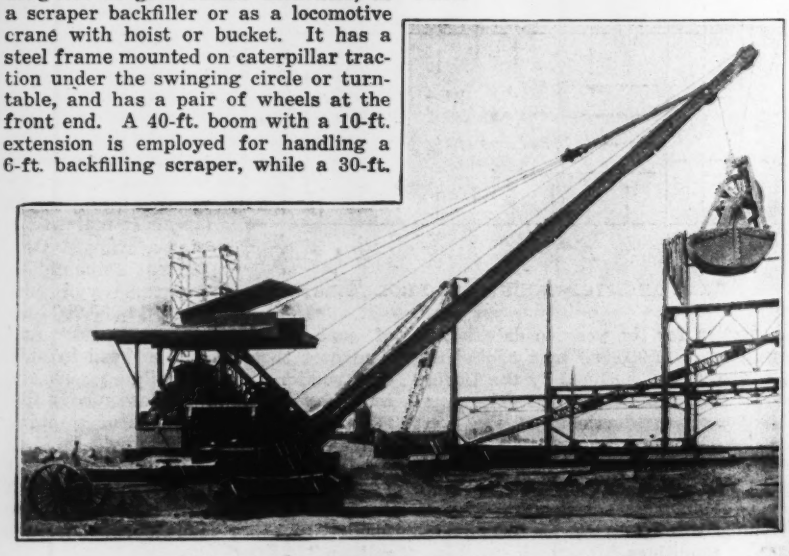
Signed by John Beal

FORM MADE OUT BY INSPECTOR

Excavator May Serve as Backfiller and Locomotive Crane

A new combination machine for use on construction work, shown in the accompanying view, can be used as a drag-line or grab-bucket excavator, as a scraper backfiller or as a locomotive crane with hoist or bucket. It has a steel frame mounted on caterpillar traction under the swinging circle or turntable, and has a pair of wheels at the front end. A 40-ft. boom with a 10-ft. extension is employed for handling a 6-ft. backfilling scraper, while a 30-ft. boom may be fitted for handling a ½-yd. clamshell or dragline bucket. The boom consists of a pair of 7-in. channels in V shape with top and bottom lacing.

A four-cylinder 30-hp. internal combustion engine drives the machinery through a shoe friction clutch inside the flywheel. The main drums are 12 in. in diameter, are driven by 24-in. band frictions and have 24-in. band brakes. Gear trains operate the swinging and propelling mechanism, the latter giving a speed of nearly one mile per hour. The machine weighs about 13 tons and can hoist a load of 3500 lb. at 30-ft. radius. It is built by the Pawling & Harnischfeger Co., Milwaukee, Wis.



EXCAVATOR USED AS BACKFILLER AND CRANE

Use of Platinum Subject to Limitations of Explosives Act

Platinum, iridium, palladium and their compounds have, by act of Congress, been made subject to the terms, conditions and limitations of the Explosives Act. The director of mines is authorized to limit the sale, possession or use of these materials.

It is stated, however, that the object is to assist the Government in developing an adequate supply of these metals without disturbing the trade any more than is unavoidable

BUSINESS NOTES

The Lakewood Engineering Co. announces the opening of new offices in Chicago in the Lumber Exchange Bldg. It also announces that the Charles T. Topping Machinery Co. has merged its interests with the Pittsburgh office.

The John C. Herndon Co. has transferred its main office from Leetonia, Ohio, to 502 Keystone Bldg., Pittsburgh, Penn.